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The Electric Light and Power Industry in 1939

THE electric light and power industry shared fully in the revival of business activity in this country which took place during 1939. Power output was up 12 per cent over 1938, per cent above the previously high ear of 1937, and exceeded that of the oom year of 1929 by 38 per cent.

Output of electricity in 1939 amount- to 128,300,000,000 kwhr compared ith 114,650,000,000 kwhr in 1938, ith 119,810,000,000 kwhr in 1937 and 2,750,000,000 kwhr in 1929.

An outstanding feature of the year's peration was the substantial increase in utput during the latter half of the year, esulting from the industrial expansion hich accompanied the outbreak of war Europe. The growth of total output electricity from August to December, owed an increase considerably above e usual seasonal increase for this peri- l, but the relation of the December, 939, output to the August, 1937, out- ut corresponds closely to the long term end of output growth of the industry d new capacity had been added during e two-year interval amply to provide r this increase.

Another feature of the year's opera- on was the serious shrinkage in water wer production during the autumn onths because of the progressive failure water supply. Rainfall was deficient om the very start of the year; by Sep- mber the drouth became acute and e year closed with many reservoirs mpty or nearly so and the streams in me areas reduced to extreme low stage. eneration of electricity by water power uring the last four months of the year n 12 to 15 per cent below that of the revious year and for the year as a hole showed a decline of 4 per cent.

On the other hand production of elec- icity by steam rose to new high records. The total for the year is estimated to have been 83,600,000,000 kwhr, an increase of 14,850,000,000 kwhr, or nearly 22 per cent over the year before. This steam power production almost equals the entire output of electricity from all sources during the boom year of 1929.

Sales of Electricity

Basing the figures on ten months' actual results (with November and December estimated) sales and revenues of electricity by the light and power enterprises of the country may be approximated as follows:

SALES TO ULTIMATE CONSUMERS

Classification	*1939*	*1938*
	Kilowatthours	
Domestic Service	21,100,000,000	19,515,000,000
Small Commercial	20,000,000,000	18,316,000,000
Large (Industrial)	55,350,000,000	46,374,000,000
All other sales	10,550,000,000	9,689,000,000
Total	107,000,000,000	93,894,000,000
	Gross Revenues	
Domestic Service	$859,000,000	$825,433,000
Small Commercial	646,000,000	609,281,000
Large (Industrial)	633,000,000	574,463,000
All other sales	166,000,000	163,063,000
Total	$2,304,000,000	$2,172,240,000

Industrial power sales were up nearly 20 per cent above 1938 and about 1 per cent above such sales in 1937. They were nearly 25 per cent above 1929. The advance in industrial sales from 1938 to 1939 closely reflected the advance in industrial activity from 86, as measured by the Federal Reserve Board index, in 1938 to 105 in 1939.

Commercial sales of small light and power also indicated an expansion of retail trade and showed a gain of 9 per cent over the year before.

Domestic service showed the usual annual growth. A new high record was set at 21,100,000,000 kwhr, a gain of 8 per cent over 1938. The average use per customer increased from 853 kwhr in 1938 to 900 in 1939. It was 500 in 1929. During the year considerable improvement in the sales volume of household electrical appliances took place, notably in the sale of refrigerators, ranges and water heaters.

900,000 New Customers

The grand total of electric customers on Dec. 31 reached 28,750,000, an increase of 900,000 over the number at the close of the previous year. Three hundred eighty thousand of these new customers were farms, two-thirds of which were on REA lines, bringing the total number of electrified farms to 1,786,000, or approximately 28 per cent of all farms having occupied dwellings. About 1,400,000 of these farms were served by the industry.

1,300,000 Kilowatts of Generating Capacity Installed

New construction in 1939 added 1,310,000 kw of generating capacity, of which amount 1,090,000 kw were installed by the industry and 220,000 by

the Federal Government. The total generating capacity, including government power plants, amounted to 38,600,000 kw at the end of the year. In addition, about 670,000 kw of generating capacity in industrial establishments are interconnected with and contribute to the public supply of electricity.

state of Tennessee, electric utilities serving the industrial centers, which have a combined installed generating capacity of 22,385,000 kw, had reserve capacity amounting to 39 per cent, or 6,250,000 kw of additional steam capacity and 60,- the year. New construction programs for 1940 and 1941 will add 2,500,000

OUTPUT AND CAPACITY

	1939	*1938*	*1937*
	(Millions of Kilowatthours)		
Generation by Fuel	83,600	68,765	74,206
Generation by Hydro	39,400	40,926	40,960
Total Generation	123,000	109,691	115,166
Purchased Energy	5,320	4,956	4,645
Total Output	128,320	114,647	119,811
	(Thousands of Kilowatts)		
Industry Capacity	37,466	36,330	34,960
Capacity supplying purchased energy	1,800	1,736	1,292
Total Capacity	39,266	38,066	36,252

Proposed Construction

New construction programs as now planned for 1940 and 1941 will add 4,315,000 kw of additional capacity, of which amount 2,830,000 kw of steam capacity and 70,000 kw of additional hydroelectric capacity will be installed by the industry and 1,415,000 kw of hydroelectric capacity will be added by government projects.

40% Reserves in Industrial Areas

In the industrial areas east of the Mississippi and north and east of the

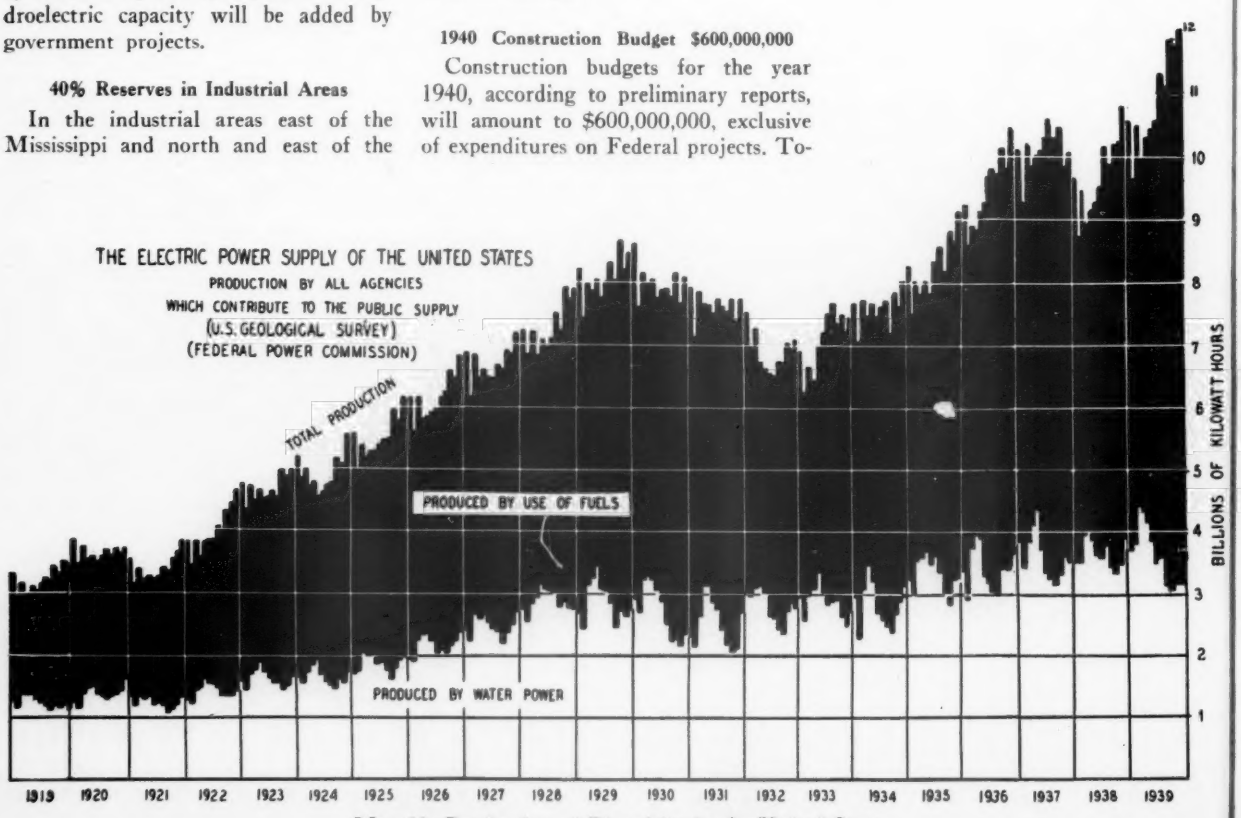
kw of additional steam capacity and 60,- 000 kw of additional hydroelectric capacity in these areas, an amount more than sufficient to maintain the present margin of reserves, which, in per cent, is now much broader than was the margin in 1917, at the time of the World War in Europe.

1940 Construction Budget $600,000,000

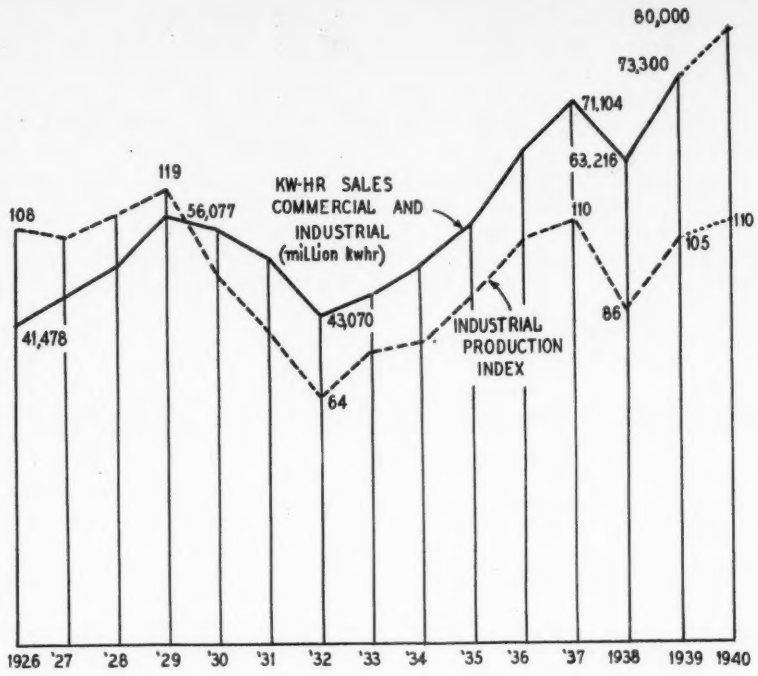
Construction budgets for the year 1940, according to preliminary reports, will amount to $600,000,000, exclusive of expenditures on Federal projects. Total construction expenditures for 1939, exclusive of Federal projects, are estimated to have been $450,000,000.

A National Grid

The mileage in the United States of transmission lines 33,000 volts and over increased from 26,400 miles in 1917 to 89,000 miles in 1926, to 120,000 miles in 1929 and 146,000 miles in 1938. This mileage provides some measure of the degree to which interconnection of electric power supply sources has advanced. In the United States, this has been a progressive development governed by economic and service conditions. Its growth was not hampered by laws, such as blocked similar development for several decades in Great Britain. As a result there are several areas in this country covered with interconnected transmission systems reasonably comparable in area with that covered by the British Grid. This progressive development may be expected to continue, but the expanse of this country is so great and the consumption of power in the various industrial areas so large that in the interest both of economy and of reliability


THE ELECTRIC POWER SUPPLY OF THE UNITED STATES
PRODUCTION BY ALL AGENCIES
WHICH CONTRIBUTE TO THE PUBLIC SUPPLY
(U.S. GEOLOGICAL SURVEY)
(FEDERAL POWER COMMISSION)
TOTAL PRODUCTION
PRODUCED BY USE OF FUELS
PRODUCED BY WATER POWER
BILLIONS OF KILOWATT HOURS
1 2 3 4 5 6 7 8 9 10 11 12
1919 1920 1921 1922 1923 1924 1925 1926 1927 1928 1929 1930 1931 1932 1933 1934 1935 1936 1937 1938 1939

Monthly Production of Electricity in the United States



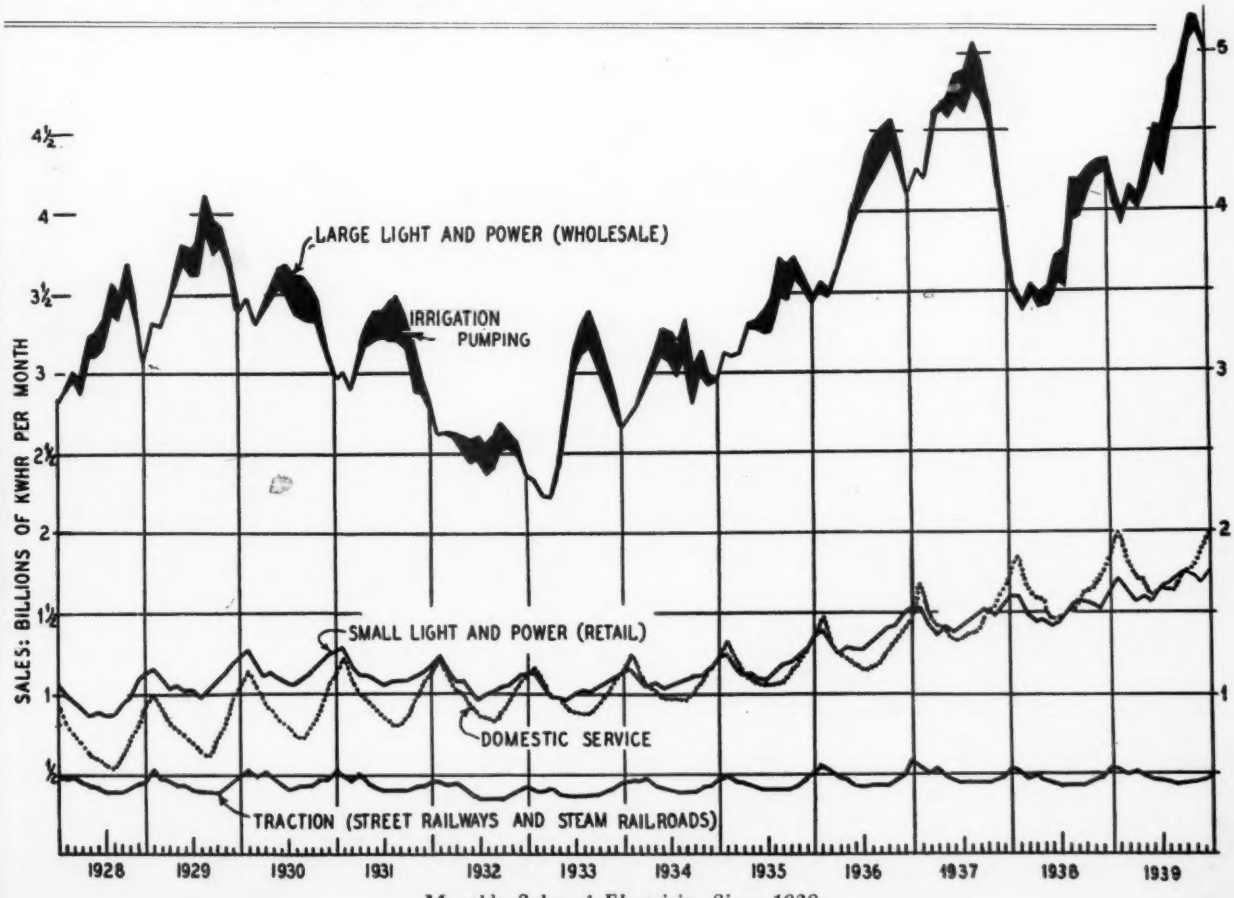
Business Activity Determines Power Sales—Many persons expect that, for 1940, the Industrial Production index of the Federal Reserve Board may average 110. If this is the case, power output this year will be up about 9 per cent over 1939

of service each area must be reasonably self-sufficient in its available generating capacity.

Rates

The price of electric service was reduced again during 1939 but at a smaller rate than has prevailed during previous years. It grows more and more difficult to reduce rates in the face of mounting operating costs, rising taxes and increased charges for depreciation. At the end of 1939 the average price of electricity for domestic service stood at 4.07 cents per kwhr as compared with 4.23 cents in 1938, with 4.40 cents in 1937 and 6.33 cents ten years ago. The domestic customer's average bill is now just 10 cents per day as compared with 8½ cents ten years ago, but in the meantime the amount of current which this customer uses has nearly doubled.

Industrial power rates, due to the large increase in consumption, declined in average price in 1939 to the lowest point since the middle of the war emergency in 1917. Sales averaged 1.145 cents per kwhr as compared with 1.389 cents in 1929. Due to these reduced



Monthly Sales of Electricity Since 1928

rates the revenues received from consumers showed a smaller rate of gain than did sales of electricity, and where kwhr sales increased 14 per cent during the year, revenues grew by only 6 per cent.

Revenues and Expenses

Total revenues approximated $2,304,000,000 for the year 1939, an increase of $132,000,000 over 1938. Many factors combined, however, to take large bites out of this added revenue, with the result that only about $50,000,000 of it was carried through to net income. The drouth made necessary the burning of much more coal and the price of coal and other materials showed some advance; taxes rose by about $20,000,000 to a new high figure estimated at $345,000,000, and represented 16 cents out of every dollar received from consumers; and charges for depreciation were also increased. Thus, net income showed a gain of about 10 per cent over the previous year but was still below that of 1929.

Refunding and New Capital Issues

Financing operations in 1939 were confined almost exclusively to refunding and approximated $875,000,000 for the operating electric light and power companies. This compares with $954,000,000 during 1938 and the recent high figure of $1,325,000,000 in 1936. New capital issues in 1939 represented less than $25,000,000.

Comments on Financial Trends

It is interesting at this time to comment on certain longtime trends for appraising which one year is too short a period to be significant. It is now a decade since the market break of 1929 which ushered in the depression. During this decade the electric utilities have shown various basic changes that affect their fundamental position. In general a gain of 18 per cent in gross revenue during the decade has been accompanied by a decrease in the earnings available for stockholders. Rate reductions produced a 17 per cent drop during the ten years in gross revenue per kwhr. The utilities have made strenuous efforts, through increased sales and operating economies, to offset this decrease in gross per kwhr and, despite an increase of 20 per cent in hourly labor cost during the decade, have succeeded in reducing the ratio of operating expenses to gross earnings from 39.3 per cent to 37.6 per cent. They have also benefited from the lower cost of bond money which has reduced from 14.0 per cent to 12.6 per cent the part of gross earnings required to pay interest charges.

The combination of operating economies, sales effort and reduced interest charges has been insufficient, however, to offset the growth during the decade in the cost of taxes and depreciation, the two combined now taking 27.5 per cent of gross revenue where in 1929 they required but 18 per cent. The net result of all these factors was that the net income for the year just ended was 22.3 per cent of gross compared to 28.7 per cent in 1929.

Put in another way, during the decade net earnings of the electric utilities available for return on investment decreased $37,000,000, thus representing no return whatever on some 3½ billions of capital investment made on private utility properties during the ten-year period.

Electric Company Taxes Increase by Nearly $20,000,000 During 1939

BASED upon the published statements of the companies reporting for the 12 months period ending with November 30, taxes paid by electric light and power companies have increased by almost $20,000,000 during 1939 and for the industry as a whole, they now take nearly a dollar out of every six received from consumers.

Much of the rise in taxes in 1939 has taken place in Federal taxation, which has doubled during the past five years. According to figures thus far published, Federal taxes in 1939 may total nearly $150,000,000 and comprise 44 per cent of all taxes paid.

The steady rise in the taxation of private electric light and power companies is given by the adjoining table, which shows taxes and revenues in recent years.

ELECTRIC LIGHT AND POWER COMPANY TAXES

Year	*Operating Revenue*	*Total Taxes*	*Ratio: Taxes to Revenues*
1927	$1,588,900,000	$150,253,000	9.5%
1932	1,738,000,000	203,858,000	11.7
1933	1,664,000,000	215,000,000	12.9
1934	1,736,000,000	243,000,000	14.1
1935	1,813,000,000	255,000,000	14.1
1936	1,941,000,000	286,000,000	14.7
1937	2,056,000,000	312,270,800	15.2
1938	2,050,000,000	325,000,000	15.85
1939*	2,165,000,000	345,000,000	15.93

Note: * Preliminary estimate: subject to year end adjustments.

Source: 1927, 1932 from U. S. Census of Central El Lt & Pr Stations 1933 to 1938 from *EEI Statistical Bulletin* #6, 1939 from assembly of published reports.

Nearly Six Dollars of Taxes Concealed in Annual Bill for Residential Service

At the present rate of taxation upon electric light and power companies, nearly six dollars a year, or 50 cents per month, are contained in the residential electric consumer's annual bill for service. In 1939, taxes took 16 per cent of consumer revenues, as compared with less than 12 per cent in 1932 and this increase in taxation has largely offset the growth in the annual payments of the average consumer. Taxes excluded, the electric light and power companies receive only $0.96 more from the residential consumer than they did seven years ago, although the amount of current furnished to him has increased by 300 kilowatthours a year, or by one-half. The growth in taxation as applied to residential service during recent years is shown by the following table:

RESIDENTIAL ELECTRIC SERVICE

Year	*Annual Bill per Consumer*	*Ratio Taxes to Revenues*	*Taxes Concealed in Consumers Annual Bill*	*Net Bill Deducting Taxes*	*Kwhr Used per Year*
1932	$33.25	11.7%	$3.89	$29.36	597
1933	32.67	12.9	4.21	28.46	595
1934	33.07	14.1	4.66	28.41	624
1935	33.53	14.1	4.72	28.81	672
1936	33.81	14.7	4.97	28.84	727
1937	34.81	15.2	5.29	29.52	793
1938	35.57	15.9	5.66	29.91	845
1939*	36.05	15.9	5.73	30.32	890

Note: * Preliminary estimate. (This table is computed on a pro rata allocation of taxation on the basis of revenues. Because the 3% Federal Tax does not apply on industrial power, this table probably slightly understates the amount of residential taxation since 1933.)

Source: 1932-1938 inclusive, from *EEI Statistical Bulletin* #6; 1939 as estimated by EEI on the basis of 10 months actually reported to date.

Long-Range View of The Industry's Gross and Net Revenues

By Edwin Vennard

Vice-President, Middle West Service Company, Chicago

A paper presented before the General Electric Central Station Sales Conference, Jan. 4-5, Bridgeport, Conn.

DURING the past six years, a new and added emphasis has been placed on the idea of decreasing rates as a means of stimulating increased sales, gross revenue and net revenue. It is proper that we should constantly strive to make our rates as low as possible consistent with good service. However, we should assure ourselves that, in the interest of the public as well as the industry, we reduce our rates soundly and not put them below present costs of furnishing service.

It seems fitting, therefore, that we examine the gross and net revenues of the industry over the past few years to study the trends as a guide in future policies. If these trends show any danger signs, the public should be told, and the sales departments, through their customer contacts, are especially well equipped to present the facts.

Six-Year Record

Chart 1 shows the utility plant investment, gross operating revenue, taxes, operating expense, depreciation and return for the private electric industry for the years 1932 through 1938. (1)

Table I shows the financial position of the industry for the year 1932 as compared to 1938.

Utility plant investment decreased slightly during the six-year period because retirements exceeded new investments.

Gross revenue increased 17% during this period, although net revenue increased only .65%. Chart 1 illustrates how little of the increased gross revenue found its way into net.

Analysis

Why has the industry shown practically no increase in net revenue in spite of 17% increase in gross revenue? There appear to be three reasons.

1. Taxes and labor costs have increased materially since 1932 as shown in Chart 2.

The industry's operating ratio as shown on Chart 3 increased from 50.6% in 1932 to 57.4% in 1938. During this six-year period, the industry's gross revenue increased $367 millions. The operating expenses (after taxes and before depreciation) increased $360 millions. Therefore, the operating ratio on the increased business was 98.2%.

2. A fundamental economic adjustment in the industry was largely completed during the 20's and the early 30's. Beginning prior to 1930 and extending into the 30's, the industry was going through the process of replacing small isolated plants with larger ones, connected with transmission line systems. These consolidations resulted in constantly lowered costs of making and delivering the kilowatt-hour. The larger generators were more efficient, overhead costs were reduced, diversities were improved and plant reserves were lowered. This constant lowering of costs allowed frequent rate reductions as the cost of making the kilowatt-hour was reduced.

Since the early 30's, operating efficiencies, while continuing to improve, were not doing so at the same rate as during the 20's. There was less to accomplish in physical consolidation. Improved operating efficiencies have been more than offset by uncontrollable, increased expenses, such as taxes. There is still more to be accomplished in further operating efficiencies and interconnections, but relatively not to the same extent as during the 20's.

3. Although operating cost trends changed in the early 30's (see Chart 3), substantial rate reductions continued. The fact that the industry has shown only a .65% increase in net with a 17% increase in gross revenue indicates one of two things has happened:

(a) The rates have been reduced too rapidly during the period, or

(b) Rates have been made too low for increased use.

There may have been a combination of these two factors.

As residential service is the largest single source of the industry's revenue, and as this service has been the center of so much attention since 1932, it is well that we examine residential rate schedules.

Much has been said about reducing rates as a means of promoting increased use of service and increased revenue. The urge has been to make residential rates more promotional. The industry has long realized that rates could be reduced rapidly for increased use of service; consequently, most companies in the industry had promotional rates in effect prior to 1932.

The question of whether rate reductions *in themselves* promote increased sales and increased revenue, will always be difficult to answer because it can never be known what the sales or revenue would have been if the rates had not been reduced. The question has

TABLE I

	(Millions of Dollars) Utility Plant	(Millions of Dollars) Gross Revenues	Net Revenue(2)	% R&D(3)
1932	$14,370	$2,168	$1,071	7.47%
1938	14,200	2,535	1,078	7.59%
Increase				
1932-1938	—170	367	7	.12%
% Increase	—1.2%	17%	.65%	1.6%

(1) The sources of information are: Bureau of Census, Edison Electric Institute and ELECTRICAL WORLD. These authorities are in close agreement on all the figures representing revenue and expense. The Bureau of Census (for 1932 and 1937) is the only authoritative source for investments. To determine the investment figures in this chart, we used the census figures for 1932 and 1937, and have assumed a uniform trend for the intervening years. Investments for 1938 are an estimate by ELECTRICAL WORLD. The actual ups and downs of these years are less important than the long-range trend so that the value of our comparison is not damaged by the lack of this detail. The figures include allied utility service furnished by electric companies.

(2) After all operating expense and taxes; i.e., balance available for return and depreciation.

(3) Per cent on investment for return and depreciation. Requirement for depreciation is about 2.5% to 3% of utility plant investment so that balance available for return has been 4.5% to 5%.

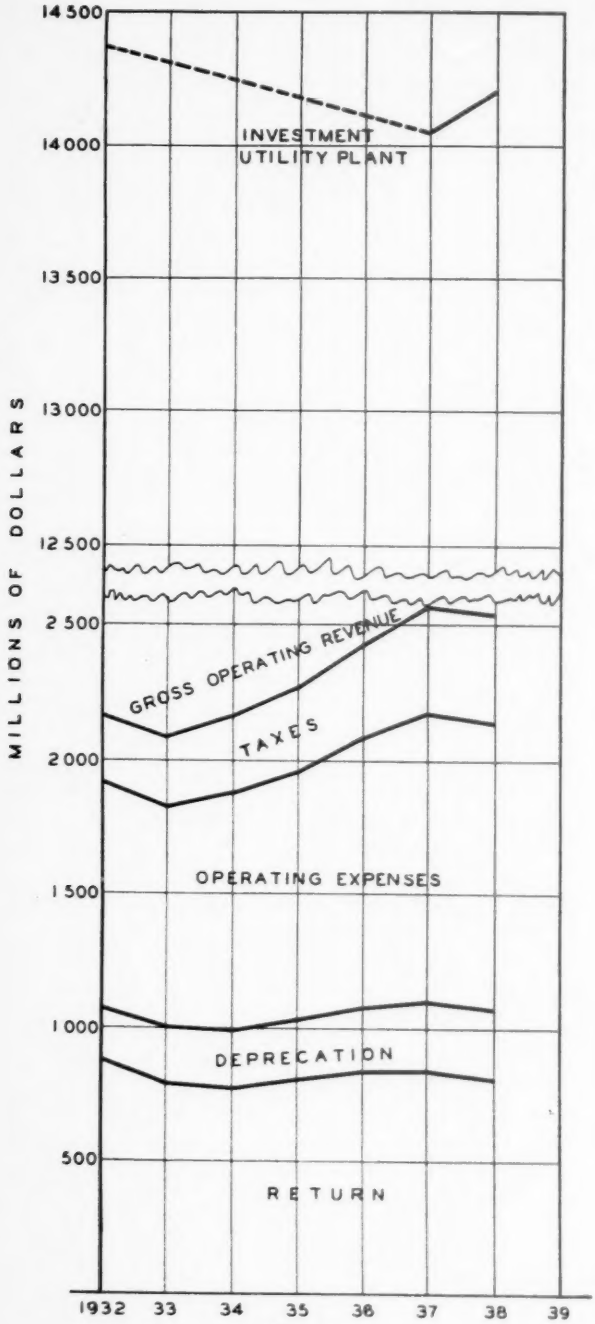


Chart 1

Six-Year Record, 1932-1938, Private Electric Industry

Chart 2

Taxes and Labor Cost, 1932-1938, Private Electric Industry

been analyzed, however, from various angles, leading to two general conclusions:

1. When rates are unusually high, non-promotional and non-competitive, a reduction results in both increased sales and increased gross and net revenues, provided that the lower rate remains above the incremental cost of furnishing the service.

2. When rates are already at a reasonable level—are promotional and competitive—a reduction may promote increased sales, but not gross or net reveenues. The gross revenue and possibly

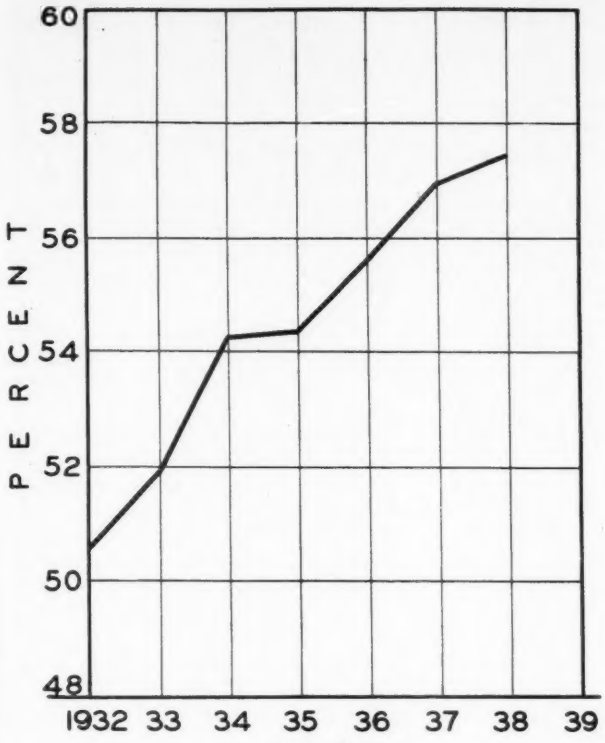


Chart 3

Operating Ratio, 1932-1938, Private Electric Industry

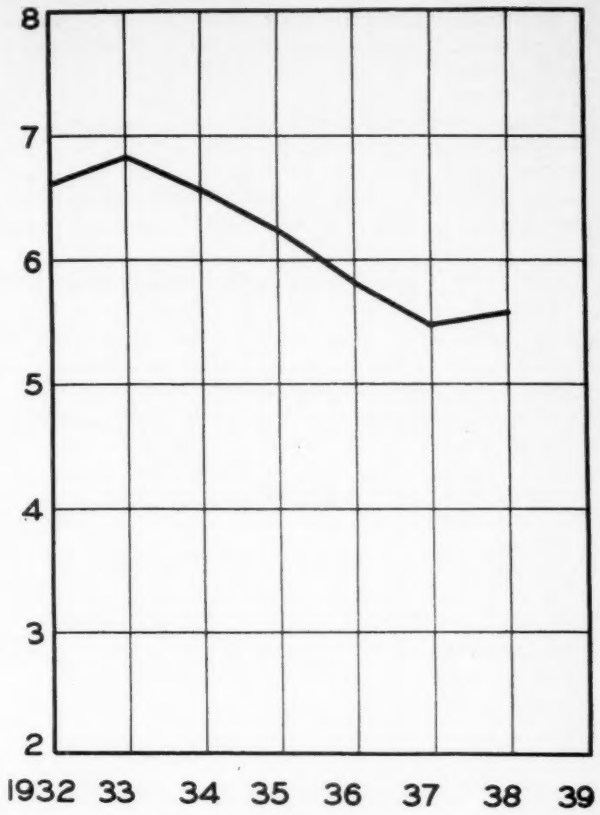


Chart 4

Investment Ratio, 1932-1938, Private Electric Industry

net revenue may be recovered following a rate reduction, but the question is: How much of the increase can be attributed to the rate change? Conclusions regarding whether the *rate reduction* promotes increased revenue can be drawn only after analysis of the particular class of service. The two principal factors affecting recovery are: first, the normal growth of the business, and, second, new business effort. The increased revenue that reasonably could have been expected from these two factors at the higher rate, must be deducted before labeling the increased revenue *caused by* the rate reduction.

A properly designed promotional rate attempts to follow the cost curve over the whole range of customer use. Such a rate automatically provides the necessary reduction for all increased use of service and at the same time enables the company to show sufficient net revenue to pay a fair return on the investment. It is possible to make rates so promotional that they go below the cost curve for increased use. Such a rate may promote increased kilowatthour sales, but will result in a decrease in over-all rate of return.

Since the industry has shown practically no response in net revenue with a 17% increase in gross revenue, it would seem that some of the rates have already gone below this cost curve for increased use.

Investments

Chart 4 shows the industry's ratio of investment to gross revenue for the six-year period. The decline from $6.62 to $5.60 is caused primarily by the decrease in utility plant investment, and by the fact that part of the excess capacities have been utilized.

Chart 5 shows the industry's per cent return before and after depreciation for the same period. The per cent on investment before depreciation was 7.59% in 1938 as compared to 7.47% in 1932.

General conditions changed so substantially in the early 30's that it hardly seems advisable to use figures prior to 1932 in studying the trends. What do the trends of the past six years show us that will be helpful in guiding our future course?

The ratio of investment to gross revenue shows a healthy trend downward. However, the conditions causing this trend do not exist today to the same extent as during the past six years. There will be relatively fewer retirements. There is less excess capacity. New equipment now being installed or scheduled for the near future will bring about an increase in over-all plant account. This ratio of plant account to gross revenue will probably now level off, or possibly increase.

TABLE II—PROJECTION OF INDUSTRY'S FINANCIAL POSITION

(Millions of Dollars)

	Actual 1938	1945 Projected 3-a	3-b	3-c
Utility Plant Inv.	$14,200	$16,593	$16,593	$16,593
Gross Revenue	2,535	2,963	2,963	2,963
Oper. Expense	1,457	1,877	1,714	1,628
Net Revenue	1,078	1,086	1,249	1,335
% R&D**	7.59%	6.54%	7.53%	8.05%
Increase $ R&D	.....	*1.05%**	*0.6%**	.46%
Oper. Ratio (overall)	57.4%	63.3%	57.8%	54.8%
Inv./$ Gross	$5.60	$5.60	$5.60	$5.60

* Red Figure. ** Remember, deduct 2.5% to 3% for depreciation to get per cent return.

The financial stability of the industry has not so far been seriously affected by this lack of increased net revenue, first, because plant account has decreased, and, second, because cost of money has decreased. However, the trends are important and if plant account is to increase and if cost of money stops decreasing, net revenues will have to increase if good credit is to be maintained.

The increase in operating ratio from 50.6% to 57.4% is the most dangerous sign. And, there is little to indicate a change in trend in the near future. Taxes, labor, material and supplies, are more likely to increase than decrease. If this operating ratio continues to rise and the ratio of investment to gross revenue remains level, the industry will show a decrease in per cent on investment for return and depreciation.

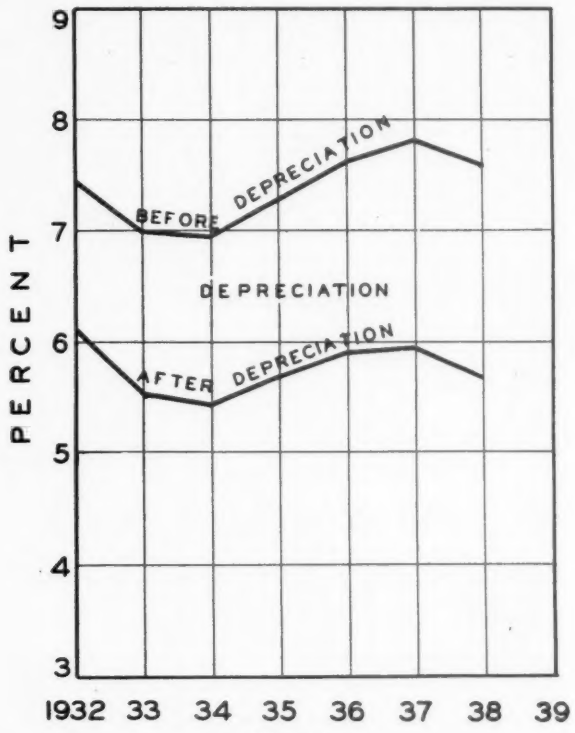


Chart 5

Per Cent Return Before and After Depreciation, Private Electric Industry

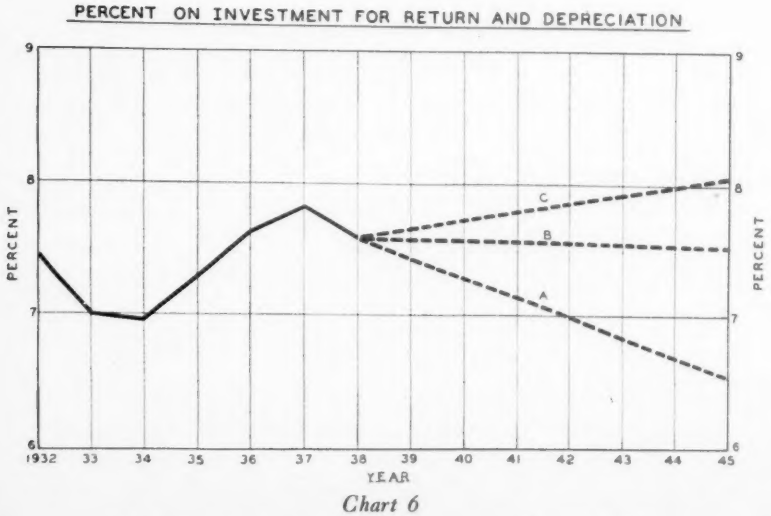


Chart 6

Per Cent on Investment for Return and Depreciation, Private Electric Industry

In projecting into the future, we will make the following assumptions:

(1) The ratio of investment to gross revenue will remain at the 1938 level.

(2) Gross revenue will increase according to the 1932-1938 trend.

(3) Projections will be made based on the following three assumptions with respect to operating ratio:

(a) Operating ratio on *increased* business—98.2%; i.e., the same as for 1932-1938 period.

(b) Operating ratio on *increased* business—60%.

(c) Operating ratio on *increased* business—40%.

The last three rows in Table II show the probable position of the industry in 1945 based on these three assumptions:

Chart 6 shows the projection of the industry's per cent on investment for return and depreciation based on the above assumptions.

Obviously, the industry cannot continue along path "a" with 98% operating ratio on increased business. If this continues, the per cent on investment for depreciation and return in 1945 will be 6.54%.

If the industry is to continue sound, it must go along path "b" or path "c" and preferably path "c." This requires a reversal in operating ratio trend. If this trend is to be reversed, rate reductions in the future cannot continue as they have in the past six years. Even the center path "b" will require a sharp reversal in operating ratio trend and this will result in 7.53% R&D in 1945 as compared to 7.59% R&D in 1938.

Conclusion

The operation of the electric utility business in public interest and in the general welfare requires consideration of four principal groups: customers, employees, government, and investors. The welfare of each group is dependent upon the welfare of the other three.

During the past six years, government has fared well with $162 millions of increased taxes. Labor has fared well with $80 millions increased payroll. Residential customers have fared well with a 25% decrease in average rate. Investors have not fared well with only .65% increase in net revenue for return and depreciation. The general welfare requires a fair return on fair values to enable the industry, first to continue to pay fair wages, and, second, to attract new capital for necessary expansion the building of which will create new jobs.

The Treadmill of Debt

A Financial History of Three Government Enterprises

By William M. Carpenter
Economist, Edison Electric Institute

THE accompanying charts and tables illustrate the financial history of the three outstanding examples of Government ownership organized in recent years;—the TVA, the British "Grid" system, and Boulder Dam. Differing widely as to scope and purpose, all three nevertheless have this in common: the expenditure of large capital sums, justified at the beginning by prophesies of early financial success, and followed by long years of struggle with fixed charges, while the taxpayers' subsidies disappear into the quicksand of arrears of compound interest.

At a time when the drastic reorganization of privately owned power companies has been demanded because the dividends on some of their junior securities have been in arrears, an examination of these enterprises which have never earned their interest charges becomes especially pertinent.

THE TVA

These figures add another year to the analysis published in the E. E. I. BULLETIN of January, 1939, and bring the history of the TVA enterprise up to the close of its sixth year—ended June 30, 1939. Table 1 shows the total for the first five years, the sixth year, and the cumulative total. Tables 2, 3 and 4 are extensions of identical tables published last year, to which the reader is referred for a more complete description of sources and methods of computation.

It will be observed that, last year, the TVA again failed to cover, after depreciation, the interest charges even on its own very-much-scaled-down "valuation" of its power-producing dams. The statements in its last annual report that it "had a net income"[1] and that it is now "on a paying basis"[2] are therefore, only pleasant fictions which ignore the fact that the U. S. Treasury pays the interest charges for this enterprise out of general funds.

At the average rate applying on outstanding U. S. bonds, last year's interest was about $2,340,000 against which is applicable a "net income," after depreciation, of $1,442,880 leaving $897,120 as the deficit for the year. To have "broken even" for the year, revenues should have been $6,404,197 instead of $5,507,077, an increase of 16 per cent.

To have "broken even" for the six years of its operation, total revenues of the TVA should have been $18,500,000 instead of $12,239,524; an increase of 51 per cent.

Much publicity has attended the financial "success" of the Alcorn County (Mississippi) Electric Power Association (which contains the town of Corinth) in showing such a profit from the resale of TVA energy that it has been able progressively to retire the $188,317 of outstanding obligations on its distribution system and to put into effect a still lower schedule of rates. Quite apart from any analysis of the details of its operating expenses, it appears from a year-by-year analysis that, if this enterprise had paid for its power what it cost the TVA even on its own valuation, its

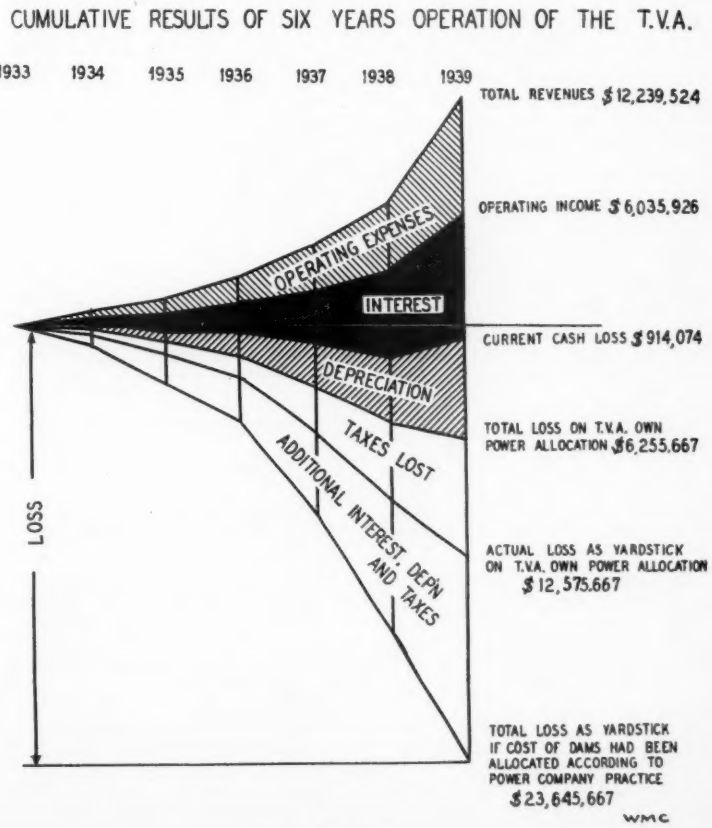


Chart 1

[1] Annual Report of the TVA, for the Fiscal Year Ended June 30, 1939, page 2, states: "Revenue of more than $5,500,000 from the sale of electricity in the fiscal year provided a net income of $1,478,000 after payment of all power expenses, direct and allocated." Also on page 59, it states that "These revenues provided a net income of $1,478,000 after all expenses. . . . The net income is also after provision of approximately $1,736,000 for depreciation. . . . Net income on the 1939 power operations exceeded by a margin of nearly $900,000 the net expense of the power program incurred during the previous 5 years."

[2] Ibid, p. 58, "Power Operations Reach Paying Basis."

TABLE 1

TVA Cumulative Income Statement	Five Years Ended June 30, 1938	Fiscal Year, June 30, 1939	Total for 6 Years to 1939
Revenues: From "outside sales"	$5,175,137	$4,933,074	$10,108,211
Interdepartmental sales	1,470,310	512,124	1,982,434
Total Power Sales	6,645,447	5,445,198	12,090,645
Other Revenues	87,000	61,879	148,879
Total Revenues	$6,732,447	$5,507,077	$12,239,524
Operating Expenses	3,602,530	2,089,548	5,692,078
Payment to States of Alabama and Tennessee in Lieu of Taxes	268,464	243,056	511,520
Operating Expenses	3,870,994	2,332,604	6,203,598
Operating Income	2,861,453	3,174,473	6,035,926
Interest paid by Treasury Dept. (Table 2)	4,610,000	2,340,000	6,950,000
Current Cash Loss to U. S. Taxpayers	1,748,547	(credit) 834,473	(loss) 914,074
Depreciation (as shown by Statement)	3,610,000	1,731,593	5,341,593
Total Loss on TVA's Own Allocation to Power	5,358,547	897,120	6,255,667
To qualify as a "Yardstick," even on its own power valuation, to the above must be added Taxes lost (Table 3)	4,080,000	2,240,000	6,320,000
Actual Loss, as Yardstick, on TVA's Own Allocation to Power...	9,438,547	3,137,120	12,575,667
The TVA, however, greatly understated the investment in power facilities; a private company would have had to charge 95 per cent of its construction to power. A truly comparable "yardstick" would therefore contain the additional interest and depreciation on this hidden investment. This additional amount is (Table 4)	7,320,000	3,750,000	11,070,000
Total Loss, as Yardstick, if Cost of Dams Had Been Allocated to Power as a Power Company Would Have Had to Have Done...	16,758,547	6,887,120	23,645,667

expenses for power during the five years of its operation would have been raised by $147,500 from $206,700 to $354,-200. With the additional interest which this system would have had to pay, this would have practically eliminated all the surplus which was used for bond retirements. With all these subsidies, it is small wonder that this enterprise now finds itself debt-free.

Far from being "on a paying basis" the TVA closes its sixth year with an accumulated cash deficit of $914,000 and an accumulated deficit after depreciation of $6,256,000 on its own property valuation. If this enterprise had paid taxes at the same average rate as the private

TABLE 2

Computation of Interest Charges—TVA's Own Allocation to Power
(In Millions of Dollars)

Fiscal Year Ending June 30	1938	1939
Completed Dams (excluding employee housing) (Schedule B)		
Wilson	$35.0	$35.0
Norris	30.7	30.7
Wheeler	31.6	31.7
Pickwick (began op'n 6-29-38)	(29.7)	29.7
Total	$97.3	$127.1
Allocated to power	52.0	67.3
Transmission, etc.	16.1	29.0
Average of Year; investment in Power	$65.4	$89.9
Average Rate of Interest	2.59%	2.60%
Annual Interest Charge	$1.69	$2.34
Total Cumulative Interest	$4.61	$6.95

TABLE 3

Computation of Taxes Lost by TVA—Yardstick Basis
(Millions of Dollars)

All U. S. Power Companies	1938	1939
Total Taxes	$325	$345
Fixed Capital (av'g of year)	12,200	12,500
Taxes per $1 Fixed Capital	2.66%	2.76%
Ratio as Applied to TVA		
Capital Allocated to Power (Table 2)	$65.4	$89.9
TVA Taxes on Company Basis	$1.74	$2.48
Less "Payments to States" by TVA	$0.09	$0.24
Taxes Lost—Yardstick Basis	$1.65	$2.24
Cumulative Taxes Lost	$4.08	$6.32

TABLE 4

Computation of Additional Fixed Charges Arising from 95%, Allocation of Cost of Dams to Power
(Millions of Dollars)

Fiscal Year Ending June 30	1938	1939
Completed Dams (Table 2)	$97.3	$127.1
95% of Above	$92.4	$120.7
Present Allocation to Power	$52.0	$ 67.3
Hidden Power Investment	$40.4	$ 53.4
Average for Year	$39.7	$ 53.4
Fixed Charges, Annual Rate (a)	6.91%	7.02%
Additional Annual Charges	$2.74	$ 3.75
Total, Cumulative	$7.32	$11.07

[a] Assuming depreciation at average rate of 1.66% for the 150 private companies reporting to the SEC; Interest and Taxes as shown by Tables 2 and 3.

companies of the country, instead of 5 per cent of its gross revenues to the states of Alabama and Tennessee, this deficit would have risen to $12,575,000. If it had charged its properties their full value as power, as any private company would have been forced to do, this accumulated deficit would have now reached the staggering total of $23,650,000.

* * *

These six years comprise the life of the TVA as a competitive enterprise; by its purchase of all the private companies in the State of Tennessee it has followed the usual course of government enterprise and become monopolistic and its next report will show great changes. Its revenues will be more than doubled and no doubt what it calls its "net income" will reach an impressive figure—providing that rain, in large quantities, soon comes again to the Tennessee Valley. But interest charges will be more than double and it will be a long time before the TVA will be able to eliminate the handicap of the $6,256,000 which represents the accumulated deficit of its competitive period.

THE BRITISH "GRID"

The British "Grid"[3] system has been more frank. Right at the start it stated that it did not immediately expect to be self-supporting, but would become so after a "limited period." The basis of the Board's operations laid down by the Act of 1926 requires it to fix its rates so as to cover expenditures, including interest and sinking fund charges, with such margin as the Electricity Commissioners may allow, not annually, but over a period of years. Accordingly, in fixing these rates, the Board envisaged revenue deficits in the earlier period of operation, to be made good by surpluses derived from the larger volume of business later. Ten years was the figure originally adopted for the development period, during which time the Board was empowered to capitalize interest and to suspend the annual provision for the repayment of money borrowed. This limit has not yet expired, but it now appears that these earlier years have rolled up a large cumulative deficit which cannot be overcome for a long time to come.

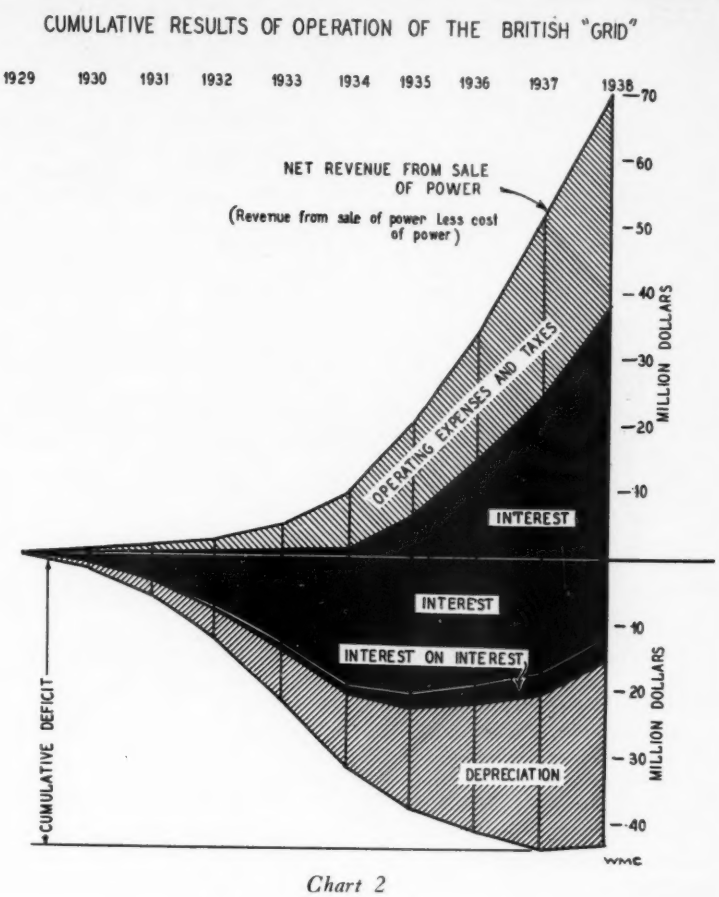


Chart 2

This system of accounting overlooks the question of compound interest on the losses incurred during the early years. A government is a vast continuing business enterprise and since, in government finance, a penny spent is a penny borrowed, the capitalization of interest means that the Government must borrow somewhere the full equivalent amount from somebody else. Budgeting for early losses and the immediate charge of interest to the capital account will thus, from this point of view, entail the borrowing of more money with which to pay this interest and the inevitable burden upon the Government of further interest upon the money so borrowed.

The books of the Grid are not kept upon exactly the same basis as those of companies in this country, but set up in accordance with accounting practices in the United States, the 1938 Income Statement may be stated as follows:

Revenues from Sales of Energy		£34,067,587
Cost of Energy	£30,213,347	
Transmission Expense	570,371	
Local Taxes	152,606	
Management and General Expenses	393,831	
Total Operating Costs		31,330,155
Operating Income, Before Depreciation		2,737,432
Depreciation (note 4)		902,504
Net Operating Income		1,834,928
Accrued Interest on Securities Outstanding		1,577,613
Profit for the year 1938		£ 257,315

[3] For details of fiscal and administrative policies, see "Notes on the Finances of the British 'Grid'" by the present author in the EEI BULLETIN of October, 1934.

[4] No mention of depreciation is made in the accounts of the Central Electricity Board and, to date, no money appears to have been applied in the purchase and extinction of securities of the Grid System. The figure shown here is derived by multiplying the average value of actual physical plant during the year (£30,083,470) by 3%.

A consolidated statement for the nine years since the British "Grid" began operations in 1929 shows the enterprise to be out-of-pocket £2,338,852 in actual cash after payment of interest. If in addition, the American point of view is adopted, it might also be said that there had also accrued a depreciation of £5,682,801. On a comparable basis with American companies, the "Grid" is "in the red" to the extent of over $40,000,000 which must eventually either be written off or recouped by increased rates. The details of this cumulative deficit are shown in the adjoining table, as computed from the various "Statement of Accounts" published annually by the Central Electricity Board.

These figures have been translated into U. S. Currency at the rate of $4.875 per £ and are shown on Chart 2.

BRITISH GRID SYSTEM—1929 TO 1938 INCLUSIVE

Total Revenues from Sale of Power		£141,314,564
Less: Cost of Power Purchased		127,026,491
		14,288,073
Operating expenses (less miscellaneous revenues)		6,564,694
Total Operating income		£ 7,723,379
Less: Interest paid on securities	£10,062,231	
Interest on annual deficits	825,000	10,887,231
Total cash deficit		£3,163,852
Total accrued depreciation		5,682,801
Total deficit, after all charges		£ 8,836,653

BOULDER DAM

"Colorado River Dam Fund—This fund was established under the Act of December 21, 1928, to provide for the construction of works commonly referred to as the Boulder Canyon project. All revenues received in carrying out the provisions of the Act are payable into the fund and expenditures are made out of the fund, under the direction of the Secretary of the Interior.

"The Secretary of the Treasury is authorized to advance to the fund from time to time, within the appropriations therefor, such amounts as the Secretary of the Interior deems necessary for carrying out the provisions of the Act, except that the aggregate amount of such advances shall not exceed $165,000,000.

"The status of advances made to the fund as of June 30, 1938, was as follows:

"ADVANCES TO COLORADO RIVER DAM FUND, JUNE 30, 1938

Advances from General Fund:		
Fiscal Years 1931-1937	$106,784,735	
Fiscal Year 1938	5,885,000	
		$112,669,735
Interest:		
Fiscal Years 1931-1937	14,928,721	
Fiscal Year 1938	4,943,425	
	$19,872,146	
Less amount (received from the sale of power) covered into the Treasury as miscellaneous receipts	2,825,632	
		*17,046,514
Total Liability to General Fund		$129,716,249

*Payment of interest due June 30, 1938, $17,046,514 deferred for 1 year under Section 2(d) of the Act of December 21, 1928."[5]

CUMULATIVE RESULTS OF BOULDER CANYON PROJECT

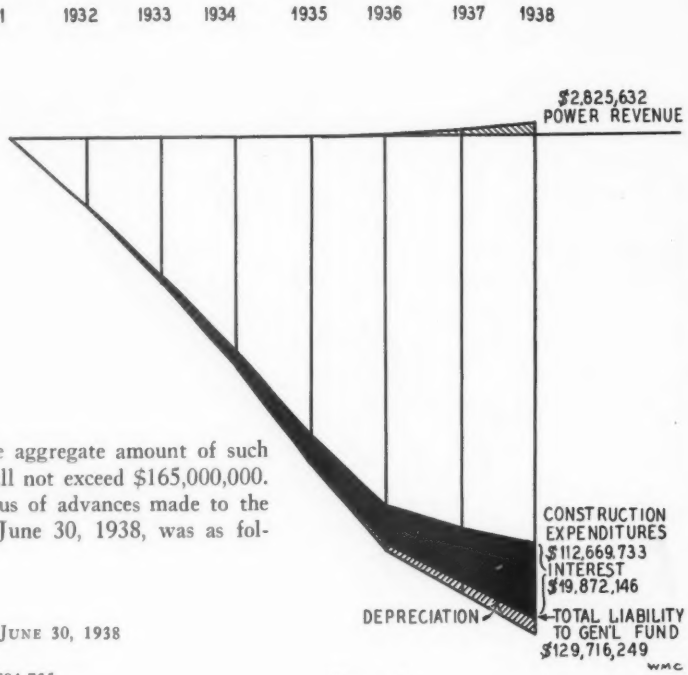


Chart 3

Chart 3 shows the growth of this liability to the General Fund year by year and for purposes of comparison with the other charts there is also shown the accruals of an estimated depreciation, taken at 0.5 per cent on the first $80,000,000 of investment (roughly corresponding to cost of dam) and 2.5 per cent on all in excess of $80,000,000 (roughly corresponding to cost of power plant).[6] According to the Secretary of the Treasury, at the close of the 1938 fiscal year, the plant cost about $113 million and net interest accumulations were $17 million.[7] Accrued depreciation

[5] Annual report of the Secretary of the Treasury on the State of the Finances for Fiscal Year Ended June 30, 1938, page 108.

[6] It may be observed that if the cost of this enterprise is actually amortized, it would not be fair to charge depreciation in addition. At the present writing, however, depreciation is certainly taking place and there is no sign of any prospective amortization.

[7] The Treasury has done a nice little banking business in loaning to the Colorado River Fund at 4 per cent money which the Government has raised at an average cost of about 2.84 per cent. Even when it is considered that the Treasury has had to raise money to pay interest on interest (which adds up to about $700,000) the total cost is only 3 per cent and the "paper profit" to the Treasury is about $6,300,000.

ciation on the basis of the above arbitrary rates comes to about $3,500,000—making a total net cost of the project, to June 30, 1938, of about $133,500,000.

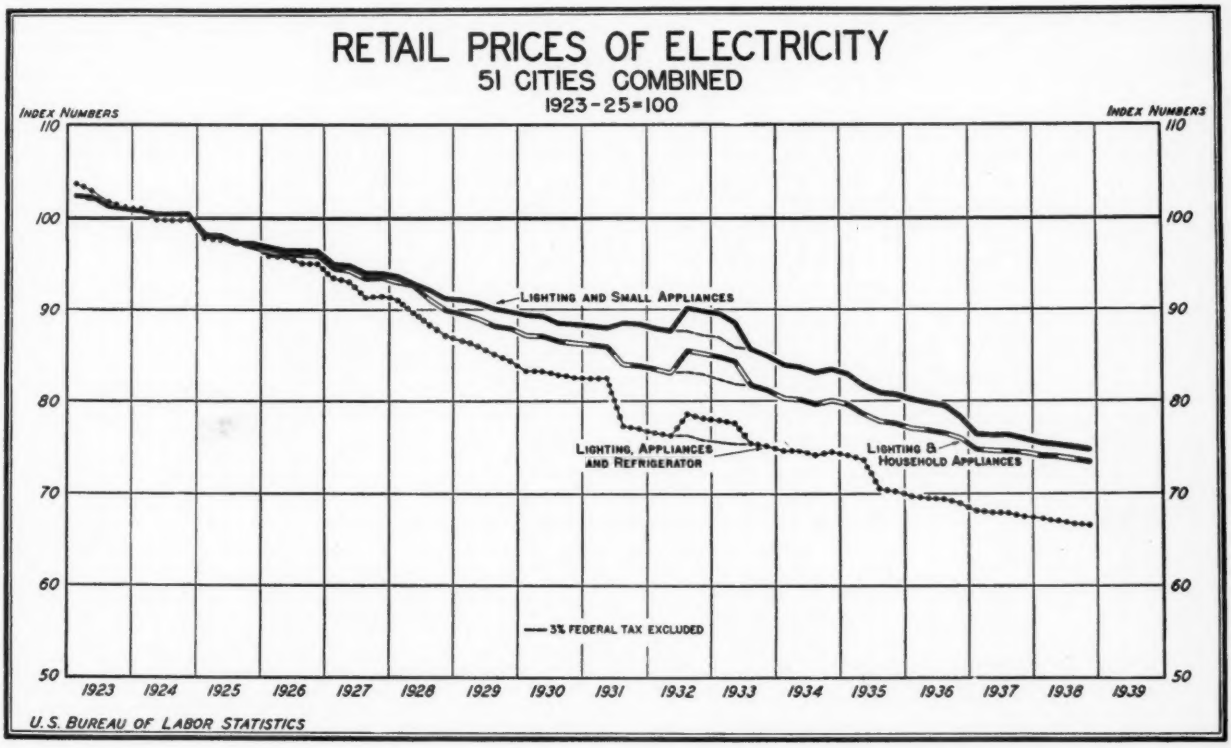
In its press release of November 14, 1930: "The Financial Plan for the Hoover Dam," the Department of the Interior stated that:

"Although the construction of this project will be a drain on the Federal Treasury for a period of seven or eight years, this enterprise should be a source of revenue to the Treasury soon after the generation and delivery of power commences. Repayment, including interest thereon during the period of construction, is to be made within 50 years from the date of completion of the works, of all moneys advanced to the fund, together with interest thereon at 4 per cent per annum."

The Treasury's report for 1939 is not yet available, but the Secretary of the Interior states that "The gross income earned by Boulder Dam during the year totaled $4,321,000."[8] On the other hand, interest on $129,716,249 at 4 per cent is $5,188,650—so that it appears that, with the eight years of construction already gone, the enterprise is still increasing its debt to the general taxpayer.

[8] Annual report of the Secretary of the Interior, for the fiscal year ended June 30, 1939, page II. AUTHOR'S NOTE: It is a popular delusion that Boulder Canyon power is cheap. This figure, divided by an output of about 1.6 billion kwhr gives an average cost of about 2.7 mills per kwhr at the Dam. The contract between the Government and the Power lessees provides that "Compensation for the use . . . of machinery and equipment furnished and installed by the United States, equal to the cost thereof including interest charges at the rate of 4 per cent per annum . . . shall be paid to the United States by the lessees in 10 equal annual installments, so as to amortize the total cost (including interest)" (Contract; The United States and the City of Los Angeles *et. al* sec. 9a). This sum is in addition to the rental of falling water at the rate of 0.163 mills per kwhr.

Mr. Scattergood, General Manager of the Los Angeles Power System, told the House Committee on Rivers and Harbors in 1937 that "The cost of Boulder power with equivalent necessary standby, at the same reliability load factor, delivered in Los Angeles is *twenty-odd per cent above what it would cost now to put in steam plant and provide it*" (HR 7642 p 75). Also that "Power under existing conditions delivered in Los Angeles on a system-load factor of approximately 55 per cent *is costing us approximately 4.4 mills.* (Hearings before Committee on Irrigation and Reclamation, House of Representatives, on Modification of Boulder Canyon Project Act HR 6629. July 11, 1939 (p 143).



"The electric utility industry made great strides during the years from 1923 to 1938, the period covered by this bulletin (No. 664 of the United States Bureau of Labor Statistics). More efficient methods reduced cost of producing and transmitting current. Promotional rate schedules were developed which offered reduced rates for a greater use of electricity. The expansion in the use of electricity for residential purposes was accompanied by and was due, in part, to the growth of the electric appliance industry. The number and kinds of appliances in use and their efficiency increased from year to year.

"The results of these developments were shown in an increase of more than 100 per cent in the average annual household use of electricity during these years. This increase was accompanied by an increase in the total revenue per customer and a reduction of about 40 per cent in the average unit price. In 1923 the average annual consumption of electricity by householders was 368 kwhr per customer as compared with 793 kwhr in 1937, the latest year for which this information was available. The average annual revenue per kwhr decreased from 7.20 cents in 1923 to 4.39 cents in 1937."—*Chart and text from "Changes in Retail Prices of Electricity 1923-1938"—Bulletin No. 664, Feb., 1939, Bureau of Labor Statistics, U. S. Department of Labor.*

PRIZES AND AWARDS

to be administered by the

EDISON ELECTRIC INSTITUTE

and awarded in 1940

Prizes to Individuals

For Papers on Subjects Relating to the Electric Light and Power Industry

FORBES PRIZE . . . . . *Public Relations*

A cash award of $250 donated by Mr. B. C. Forbes, Editor, Forbes Magazine, for the most meritorious paper dealing with the subject of Public Relations in the Electric Light and Power Industry.

McGRAW PRIZE . . . . . *Engineering*

Cash prizes of $250, $150 and $100 donated by Mr. James H. McGraw, Honorary Chairman, McGraw-Hill Publishing Company, for the three most meritorious papers on any Engineering or Technical subject relating to the Electric Light and Power Industry.

RULES AND CONDITIONS OF CONTESTS FOR ABOVE PRIZES TO INDIVIDUALS

Any person employed by an electric light and power company is eligible to enter the competition. No person is eligible to win two years in succession the identical prize or lower prize of the same award, but is eligible for a higher prize of that award. Papers must be the original work of the author or authors, prepared exclusively for this competition. Papers may be of any length, and pen-and-ink drawings or photographs suitable for reproduction may be included. Papers should be typewritten on one side only.

The first page of the manuscript must give the following information: the name of the prize for which the paper is submitted, title of paper, name of author, name and address of employing company, title or character of position and home address. One paper may not be submitted for more than one prize.

Papers not receiving awards will, upon request, be returned to contestants after the awards have been announced at the 1940 Convention of the Institute. Prize winning papers will be available for inspection at the general offices of the Institute.

Papers for above prizes must be forwarded, in duplicate, by March 1, 1940

Awards to Individuals

For Accomplishments or Acts as Specified

THE R. B. MARSHALL AWARD . . . . . *Electric Ranges*

A cash award of $500, divided into five equal parts of $100 each for utility representatives who sell, lease or rent during the calendar year 1939 the greatest number of individual domestic electric ranges of a rated capacity of seven kilowatts or more.

The purpose of this award is to promote greater activity and efficiency among utility retail salesmen.

CLAUDE L. MATTHEWS AWARDS . . . . . *For Valor*

For acts of devotion to duty wherein extraordinary courage has been exercised in efforts to maintain important electric service or to restore service in the shortest possible time.

Three cash awards each of $150 are offered for the calendar year 1939 by Mr. Claude L. Matthews, Vice President, W. N. Matthews Corporation, to the individuals selected on the basis of evidence submitted, as being most entitled to the awards. A citation and an appropriate button or pin will accompany each cash award.

Recommendation for the award must be submitted by the President or acting executive head of the company in which the person recommended is or was employed. All recommendations for the year 1939 must be forwarded to the Secretary of the Edison Electric Institute not later than *March 1, 1940*. It is urged that a recommendation for the valor award be submitted as soon as convenient after the occurrence of the act of valor.

Statements substantiating entries for above awards must be forwarded, in duplicate, by March 1, 1940

Complete details concerning the two above awards should be secured from the Secretary, Edison Electric Institute, 420 Lexington Ave., New York, N. Y.

Awards to Companies and Individuals

For Accomplishments in Specified Activities

CHARLES A. COFFIN AWARD

Sponsored by the General Electric Company

A Gold Medal, known as the Charles A. Coffin Medal, will be awarded for the year 1939 to the public utility operating company, within the United States, which has achieved the greatest advancement in its operations and physical plant, thereby making a distinguished contribution to the development of electric light and power for the convenience of the public and the benefit of the industry. The company awarded the medal will also receive $1,000 for its employes' benefit or similar fund.

GEORGE A. HUGHES AWARD

Domestic Electric Cookery Load

Three prizes donated by Mr. George A. Hughes, President, Edison General Electric Appliance Company, Inc., consisting of trophy or certificates to the public utility operating companies within the United States which, during the year 1939, have made the most distinguished contribution to the development of the market for electric ranges through promotion or selling, or both, directly or cooperatively, or both, and cash prizes totaling $1,000 to the individuals responsible for the achievement. First prize—to the company—a trophy; to the individual or individuals responsible—$500; Second prize—to the company—a certificate of recognition; to the individual or individuals responsible—$300; and Third prize—to the company—a certificate of recognition; to the individual or individuals responsible—$200.

AUGUSTUS D. CURTIS AWARD

Lighting of Buildings

A certificate donated by Messrs. Darwin Curtis and Kenneth Curtis, of Curtis Lighting, Incorporated, in memory of Augustus D. Curtis, to the public utility operating company within the United States which, during the twelve month period ending March 1, 1940, has shown the greatest contribution to the advancement of Artificial Illumination of interiors or exteriors of Commercial and Public Buildings, and a cash prize of $300 to the individual or individuals in that company responsible for the achievement. A second prize of $200 and a third prize of $100 to the individual or individuals responsible for the achievement of the companies adjudged second and third in the contest.

THOMAS W. MARTIN AWARD

Rural Electrification

A bronze plaque donated by Mr. Thomas W. Martin, President, Alabama Power Company, to the public utility operating company within the United States which, during the year 1939, has shown the greatest contribution to the advancement of Rural Electrification-Agricultural advancement within the company's territory due to uses of electricity, development of rural load, cooperation with other agencies, extension of rural lines, organization and plan for conducting rural electric development.

Presentations of accomplishments must be forwarded by April 1, 1940

IMPORTANT—Complete details for the Charles A. Coffin Award, the Augustus D. Curtis Award, the George A. Hughes Award, and the Thomas W. Martin Award should be secured from the Secretary, Edison Electric Institute, 420 Lexington Avenue, New York, N. Y. Elaborate and costly exhibits are unnecessary. The merit of the enterprise presented in papers or exhibits will be the prime factor in determining awards, without regard to the size of competing companies.

Papers and Exhibits for 1940 prizes should be addressed to the Secretary, Edison Electric Institute, 420 Lexington Avenue, New York, N. Y. Winners will be announced and prizes awarded at the 1940 Convention of the Edison Electric Institute

PRIZE AWARDS COMMITTEE: Charles W. Kellogg, James E. Davidson, H. P. Liversidge, *Chairman*, Lewis B. Beatty, *Secretary*

On Living Electrically

By C. E. Greenwood
Commercial Director, Edison Electric Institute

"GOD Bless Our Home" is a motto that has decorated many an American home. The modern version will read "God Bless Our Electric Home." The few that have one enthuse about it. The many thousands of women that do not enjoy one will pass through for inspection and view it with admiration and yearning. Must we not in the utility industry therefore make more of these electric homes our ultimate objective?

The elements going to make up this medium of improved social and economic values naturally group themselves into diverse lighting equipment; the all-electric kitchen; heating and ventilation; the electric home laundry and miscellaneous electric household servants for utility, comfort and entertainment. Three of these five groups have been, and are being further promoted through coordinated industry activity. We are on the way to speeding up, through similar means, the adoption of the Electric Home Laundry and also Conditioned Air and ventilation in the home. Once these projects are achieved, we are in a stronger position strategically to discharge our duty to market the broader concept—the All-Electric Home.

Through years of scientific research and development there have been produced scores of electrically operated heating and motor driven devices which can be made common to the $2,500 house or the $25,000 residence and upwards. The years that have passed have brought out of the pioneering stage, through manufacturer and utility educational and promotional effort, practical applications for most of the present household services.

As we scan the horizon for new services that electricity may perform for the housewife, we see no labor saving appliance that is required. The major chores can be accomplished with equipment now available. The problem before us is extensive marketing of these services, and progress will be confined chiefly to the perfection of the present offerings of the manufacturer.

At this point someone will mention that elusive thing called Saturation. We use such figures as a guide in future selling. Looking at the record we find electric irons and radios have passed the 100 per cent mark. Irons were sold in the earliest days of the utility industry and won their place in the home through the helpful service given at low cost for the appliance, and for the electricity to do the arduous work. The electric radio was a comparatively recent development, and through its amazingly rapid perfection, its appeal for entertainment of young and old and for bringing news of people and events from everywhere, public demand brought radio to a saturation equivalent to irons. The sit-down-to-ironer is just beginning to take hold as practical and attractive products are being produced.

Another of the early appliances was the washing machine, outstanding in the list of labor-savers. Many years later the electric refrigerator with its numerous appeals including effective food protection, low cost service and its modern styling, registered meteoric volume as it was driven forward by a sustained National promotional program. Extensive advertising and publicity arrested the favorable attention and acceptance of the housewives of the country for this product, putting refrigerators in the same saturation class as the washing machine at approximately 55 per cent.

The universal question each day—"What is the correct time?" is satisfied by the electric clock. A combination of styling with utility has brought saturation of this household item to over 50 per cent, or approximately the same as the old established vacuum cleaner which has been calling "Sweep no more my lady" for twice the marketing period enjoyed by the clock.

Other appliances such as the table cookery group, the mixer and those contributing specifically to health and beauty are in various stages of public acceptance. The manufacturers have made such gratifying contributions to the efficiency and styling of these groups that "replacements" of some of them are keeping pace with virgin sales.

The range and water heater services are advancing under the propelling power of synchronized action of all industry branches in promoting and selling. There is still a yeoman's job to be done to double and triple low saturations of both items against keenest competition. The all-electric kitchen is the keystone of Electrical Living, and during the coming year the functioning machinery of the industry will show commendable results in further adoption of this idea.

Now coming to the health aspects in our design for living, opportunities are revealed for further research and development beyond ready comprehension. For sixty years we have witnessed one outstanding contribution of research after another in the field of lighting, and strangely enough it is in this same field that we may look for distinct contributions for our health and comfort in the home. The efficacy of ultraviolet light in helping us to keep well, lamps to help purify the air and for sterilizing processes may be anticipated additions in our scheme of living.

Dr. Matthew Luckiesh of General Electric Company, a leading authority in the field of lighting research, stated in a recent address before the Middle West Service Company that "Ultraviolet energy may or may not be associated with artificial light in our eventual practices. If it is, we will eventually have a world illuminated with light for easy seeing, ultraviolet (of wavelengths found in sunlight) for health, and ultraviolet (of still shorter wavelengths) for sanitation and protection from contagious and infectious diseases. With efficient, practicable tools available, installations carefully designed and studied under conditions of laboratory control are necessary to place these applications of ultraviolet energy upon a sound foundation." These developments, coupled with revolution in present lighting practices which should be expected, will result in establishing sharp increases in energy use through lamps of varying types.

Whatever may be lurking below the horizon in new uses for the home is a matter of conjecture. Those in the utility industry concerned with the econom-

A Modernized Electric Kitchen in the Medium Price Class

ics of operation, as well as the social and economic welfare of the domestic consumer, are gratified to know that in the next decade there is a stupendous market for household appliances as now known to the Public. This will be an era for the Quota Busters to do their stuff, because those laboring in the field of domestic kilowatthour growth will be on the treadmill so to speak. To further explain: increased radio kilowatthours will come, but mostly from new homes. In the hundreds of thousands of refrigerators that will be sold in the next decade, replacements will represent a substantial percentage of sales. These were estimated at 18 per cent in 1939, and in two or three years will probably reach 40 per cent. Every one of these new refrigerators will replace older style boxes less efficient to operate, and there will be high mortality in kilowatthours from present customers. Keener competition between cooking fuels is recognized, and again new ranges that replace the old will be more efficient. Such changes must be welcomed in the customer interest, but compensation must be made in energy output through greater sales among the whole gamut of household electrical servants.

It is natural that the utility should look to the new houses to be built in order to make substantial gains in domestic output, beyond normal growth. The New establishes standards for the Old. Are the people who will occupy the hundreds of thousands of new homes to be built in the next few years to Live Electrically? Will the keystone of Electrical Living—that all-electric kitchen—be sold by the industry to new home seekers? Thousands of these houses constructed under the promotion and guidance of Federal agencies will have electrical equipment only if it has been built-in at the time of construction of the house, because it is only the planned kitchen type that will qualify for an insured mortgage under the FHA plan. Commercial men who are alert to their opportunities will follow, therefore, these valuable prospects.

Inevitable success in selling is just around the corner because now it is possible to make "Electrical Living" common to all classes. It is possible for the small home and small family to have a kitchen with electric cooking, refrigeration, and limited water heating facilities with an investment not much in excess of $100. Then there will still be others of beauty and efficiency that extract the "ohs" and "ahs" of housewives at much higher prices.

The trend in the cost of the equipment is downward. Rate trends have been in the same direction. Rate structures which favor the householder in the more abundant use of electricity is now an old story. Over 80 per cent of the domestic customers of the utility are in communities where a rate is available of 3c or less for electric cooking, and over 40 per cent are offered a rate of 1½c or less for water heating. The recent report of the Federal Power Commission points out that the rates for domestic electricity show decreases of from 11.7 per cent to 15.4 per cent, in the last four years. Rates dropped 14.5 per cent between 1934-39 for 25 kwhr of electricity, 11.7 per cent for 100 kwhr and 15.4 per cent for 250 kwhr.

However it may be needless to point

Low Cost Kitchen With All Electric Equipment

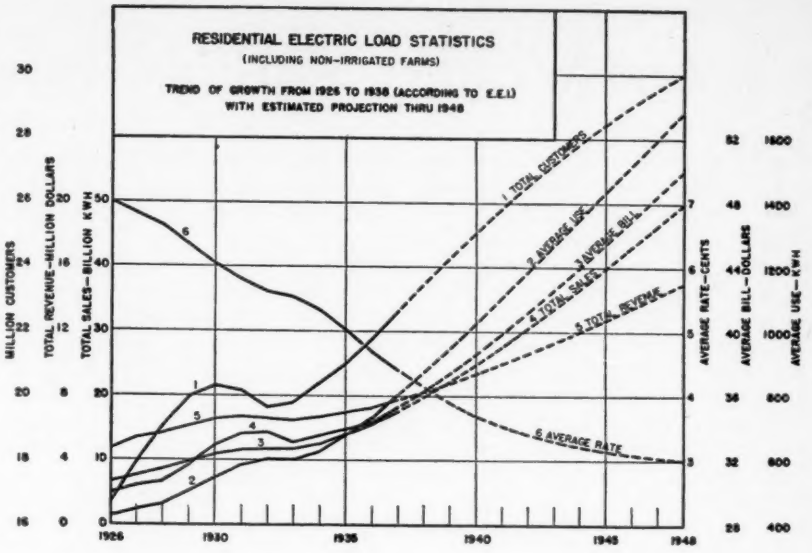
out to experienced and discerning minds that low rates though conducive to greater use, do not by any means assure it to the degree that some of the Government ownership banner-carriers maintain. Our political friends who wish to build an argument for low electric rates, irrespective of economic justification, base it on this fallacious premise. The broader question arises "Does the customer want that specific service?" The answer to this query is not a mere matter of rate.

Rate alone will not establish Electrical Living. More than one opportunist, with a political rather than a social interest in Electrical Living for the millions, has bumped his head against the wall of realities. Witness experience with some customers of TVA and REA. If a housewife finds no surplus in the family funds to buy a washing machine or a range of her desire, a rate as low as one cent for electricity is of no value. And likewise, if there is a surplus, but a housewife does not want the washing done at home, has indigestion from eating waffles or prefers gas for cooking, a one cent rate for electricity will not influence the use of these services.

Suffice it to add that the utility industry has been preparing its foundation for Electrical Living so far as rate for the service has a bearing on achievement. There is yet room for improvement.

Again we inquire, has the customer ample wiring capacity to use the appliances, and if an outlet is not available at the point service is desired, will the customer make a further investment for outlets. Unfortunately for the utility industry electricity is not peddled out to the consumer directly from a wire. A piece of electrical equipment must be attached to that wire to render a service. This requires an investment by the customer. Will it be made? Only if well-planned promotion overcomes all the factors in sales resistance.

In mapping the future course for load building effort there will be woven into the business fabric the selfish motive of the utilities. They must be kept sound financially in order that they may adequately serve the millions depending upon them for efficient service. It follows that profound thought will be given by the commercial executive to what devices in this scheme of Electrical Living will produce greatest net revenue for the company and merit greatest promotional investment. To safeguard present load, and net revenue, means that billions more kilowatthours must be sold than was represented by our previous pace in growth. One cannot magnify too much the emphasis required on SELLING. This period of exploitation is one that challenges the imagination. There is the added exhilaration of fighting to electrify the homes of the nation despite the external lightning across the seas and internal political thunder on our own shores.



Out of the maze of these complications we plan our attack on the job ahead. Perhaps the magnitude of the task may best be visualized with the adjoining chart which was prepared by one of our leading commercial executives with a keen knowledge of the possibilities of future growth as indicated by performance in his own company. The chart was prepared two years ago.

If we were to modify this optimistic view of future business as applied to the entire industry on the basis of actualities at the close of 1939, we would change the curve of "total customers" with a drop of approximately 700,000. The "average use" curve would be dropped 50 kwhr and "total sales" by approximately a billion kwhr. This would change the form of the curve but not the terminals. Assuming the 700,000 customers, that did not materialize, used as high as 500 kwhr each for the first years connected, we would make up but 350 million kwhr of that lost billion. From which we conclude that a loss of the balance of 650 million was the result of an abnormal increase in replacement sales. Promotional rate forms would have adjusted average rate to the chart estimate with the additional volume of energy sales.

Mr. G. E. Whitwell, Vice-President of Philadelphia Electric Company, who prepared this chart in connection with a paper on FUTURE LOAD BUILDING POSSIBILITIES stated in his summary, "To make my predictions come true, we, of the utilities, must do at least three things. We must supplement actively the manufacturers' promotions; merchandise, and/or cause to be merchandised, equipment in unprecedentedly large volume; and see to it that our rates, though compensatory, are favorable."

Such estimates are valuable as straws to indicate the revolutions that attend load building activity. They lay down another challenge to the commercial forces of the utility industry. Commercialism in utilities has grown stronger and more effective in the process of consolidating gains in spite of adversity. The utility must continue to plan and coordinate the elements of the industry in the task of establishing Electrical Living as a standard, taking leadership locally in promoting greater electrical development in the homes they now serve, and all the new ones to come. Possibility of success will depend upon the optimism and determination to achieve the objectives that we in the utility sales field establish for ourselves.

The Weather and the Power Companies

THE problems of weather forecasting as they affect the operation and maintenance of power systems were extensively considered at a meeting held in Washington, January 19 and 20. The meeting, the first of its kind yet held, was sponsored by the Systems Operation Committee and the Hydraulic Power Committee of the Pennsylvania Electric Association, in cooperation with the United States Weather Bureau. Attending by invitation were private meteorologists and representatives of the E.E.I. Transmission and Distribution Committee and the Hydraulic Power Committee. William R. Hamilton, Chairman of the P.E.A. Systems Operation Committee presided at the meeting.

In an introductory talk, Commander F. W. Reichelderfer, Chief of the Weather Bureau, outlined briefly the authority under which the Bureau operates and the scope of its present activities. Weather forecasting was started as a function of the Federal Government in 1870, when the Signal Corps of the Army was charged with this activity. In 1890, the present Weather Bureau was formed in the Department of Agriculture and the functions previously carried on by the Signal Corps transferred to it. Since that time, further responsibilities have been added, particularly special services required in connection with safety of air commerce.

The Weather Bureau collects and disseminates information from over 300 weather stations in the United States twice every day, at 7:30 a.m. and 7:30 p.m. In addition, intermediate reports are obtained from a number of these stations at six-hour intervals and also from other stations when important weather conditions are developed. The Weather Bureau has between 4,000 and 6,000 cooperative climatological stations which forward particular data as conditions may require.

The various stations obtain surface measurements of pressure, humidity, temperature, wind velocity, precipitation and general weather conditions. These, in general, represent conditions for a very limited altitude. In order to take advantage of recent developments, thirty stations are equipped to record information on the upper atmosphere, at elevation up to 50,000 to 75,000 feet. The recording of upper-air conditions was started about 1918. Kites, and later airplanes were used for these observations. Instruments are now sent aloft with radio-equipped balloons to transmit temperature, pressure and relative humidity. Pilot balloons are used to determine the direction and velocity of upper air currents. This extending of observations into the upper atmosphere opens a new field to weather forecasting in which the developments have been extremely rapid during the past decade.

Information is collected at the Weather Bureau from each of the stations throughout the country, and immediately tabulated on maps which show conditions of weather over the United States as of 7:30 a.m. and 7:30 p.m. Based on this information the general weather forecasts are made. In addition to this general service the Weather Bureau renders special service to the aviation industry, to fruit growing regions for protection against frost, to national forests for protection against fires; flood forecasts, warnings of the approach of hurricanes and general climatological service for agriculture.

Since the public Government agencies and private interests are all affected by the weather, the current plans for the bureau provide for expansion and modernization to increase the regular service which it is giving and also to increase the special services rendered to private industries whose functions are influenced by weather conditions.

Mr. C. W. Mayott of the Connecticut Valley Exchange, pointed out that power companies' operations were affected by wind, glaze, lightning, rainfall and flood. The location and amount of glaze and wind is important in relation to possible damage to overhead lines. Lightning likewise affects the operations of all overhead lines. Rainfall affects utility systems in relation to operation of hydro plants in conjunction with steam plants. Excessive rainfall creates possible flood conditions that might affect large areas. Advance information on abnormal weather conditions permits the better organization of crews and supplies to take care of such emergencies as might arise. Mr. Mayott gave several examples of past disastrous storms to demonstrate the points he was discussing.

Mr. C. O. Phillips of the Pennsylvania-New Jersey interconnection emphasized the importance of advance knowledge of weather conditions on load forecasting. Experience has shown that on this interconnection system of around 1,500,000 kilowatt capacity, the degree of cloudiness and time of occurrence may affect the capacity requirements by as much as 15 per cent. Mr. Phillips also discussed the effect of temperature change on loads and gave estimates varying from zero to almost 0.5 per cent change in load for each degree change in temperature. An analysis of wind conditions shows that wind velocity also has a material effect on the load of power companies and particularly on loads of electrified railroads. Humidity has an effect on load and studies of this effect are still in the development stage.

Mr. Turner of the Conowingo Power Company reviewed some of the developments in river forecasting that have been carried through in Pennsylvania.

Mr. A. S. Fry of the Tennessee Valley Authority reviewed the studies of weather conditions that have been made in order to improve the operation of the Tennessee Valley development. In this development, it is necessary to know how much rain is to be expected and about when it will occur in order to make maximum use of the storage space available. Plans have recently been inaugurated for a cooperative river and flood forecasting service on the Tennessee River, including a unit for forecasting weather conditions over the Tennessee Basin.

Mr. J. G. McKinley of the West Penn Power Co. summarized the various questions received from the power companies prior to the meeting, indicating their needs in connection with weather forecasting. Information is needed on the amount, time of occurrence and location of precipitation in order to properly operate hydro-electric plants, and on glaze, wind and lightning for the design and operation of

(*Continued on page* 39)

Market Research and Analysis

By R. H. Fite, Jr.

Head of Sales Department, Ebasco Services Incorporated

Presented at General Sales Conference, Southeastern Electric Exchange, Atlanta, Ga., Nov. 3, 1939

IT has often been said that there are two ways for a Sales Manager to run his department. One way is to run it on the basis of facts. The other method is to run it by inspiration; in which case it probably will run him ragged!

Every science is built on facts, and the science of sales management should be no exception. Sales effort cannot be guided effectively by guess work any more than it is possible to navigate an ocean liner by looking over the side of the boat. In both cases successful navigation depends upon instruments intelligently used and facts that are reliable. In sales work these facts deal with the market and the people that make it up. The instrument used to gather these facts is Market Research. I want to express some ideas about Market Research which grow out of the experience of 27 utility operating companies in this country—for which companies Ebasco Services Incorporated acts as a service organization and clearing house.

In the Sales Department we try to get all of the best sales ideas from everywhere we can and send them along to our client companies. We try to apply an objective viewpoint to the sales problems of these companies. Such a viewpoint is hard to achieve from within an operating company because there are always so many operating problems which demand immediate attention.

In this consulting sales work we are constantly studying timely and pertinent sales subjects. The most important of these studies are prepared in booklet form and made available to all of our clients. We have issued basic reports, for instance, on such subjects as Dealer Development and Coordination, Home Service, Sales Promotion and Advertising, The Unsold Customer, and Load Mortality.

In addition to this kind of work, there is issued each year by the Ebasco Sales Department a series of Sales Suggestions

for consideration of client companies, suggestions about the type of utility service that seems to be most in need, and suggestions of things that seem to promise the greatest opportunity for the ensuing year. These suggestions are presented to the companies in the fall of each year, at a time when a large Sales Conference is usually held.

This year the client companies asked for a book on Market Research. They said they needed it in order to know better how to use and plan their own extensive Market Research Programs—programs designed to secure more facts about the market for utility service. As a result of these requests, a book on Market Research was prepared.

I could talk for some time on what went into that book—the research that went into the book on research, so to speak. It was very comprehensive. One man spent almost a year on it. A lot of people spent other periods of time on it. It is a book of principles, not a program. It discusses the whole Market Research problem from A to Z and relates, from client company experience, how various aspects of the problem can be solved.

The purpose of this book is to help our client companies understand and use Market Research to secure facts which will help them obtain better sales results. Its value is that it will help sell more utility service.

If an attempt were made to summarize the basic sales problem now facing the utility industry, it would line up something like this:

—Most utility customers want and need more utility service
—Certainly everybody in the utility industry wants to sell them more service
—The service is available
—The service is cheap
—The whole trouble is that people do not yet realize how cheap it is, nor what it can do for them

The big job which lies ahead, therefore, is to find the most effective way of convincing our customers that utility service *is* cheap so they will use more of it.

It is safe to say that no utility sales manager has ever had all the facts he would like to have in deciding upon his sales objectives and in building his sales program to reach these objectives. But now he has a new tool, Market Research, whose very purpose it is to provide many of the facts which he needs so badly.

The value of Market Research, as we have considered it in writing the book under discussion, is that *market research takes the guesswork out of selling.*

In short, it applies the calipers to any part of your market, and tells you what the conditions really are there.

All of us are more or less aware of the need for more market analysis. But even so, few of us appreciate ***how urgent*** that need really is. One of the best ways to get a picture of this is to compare the amount of money spent each year on Market Research and the amount spent on product or production research.

Dr. L. D. H. Weld, director of re-

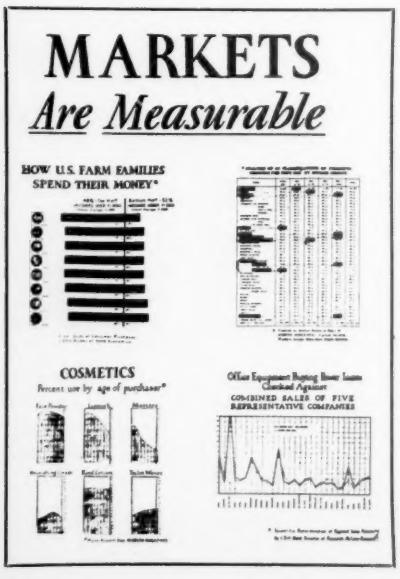
search at McCann-Erickson, has recently completed such a study. His findings indicate that the *use of market research lags way behind the use of research to solve product and production problems.*

Dr. Weld estimates that there is an expenditure of two hundred million dollars in the United States each year to learn how to produce goods and services. This expenditure involves the full time services of some 35,000 men. Market Research, on the other hand, it is estimated, only receives an annual expenditure of approximately five million dollars, and the full time services of some 500 men. In other words, in spite of the fact that the real problem now is to sell rather than to produce, 40 times as much is still being spent to learn how to produce goods and services than is being spent to learn how to sell these same goods and services.

This same condition exists in the utility business, and since real business success can only come when all phases of the business develop side by side, it is obvious that more attention to Market Research is badly needed.

The very foundation of Market Research is predicated upon the principle that markets and methods of selling can be evaluated—that the same analytical process of study that has proved so successful in production can also get results when applied to markets and people. In other words, that *markets are measurable.*

The best proof that markets are measurable is that they have been measured, and here are four examples of how markets actually have been measured.

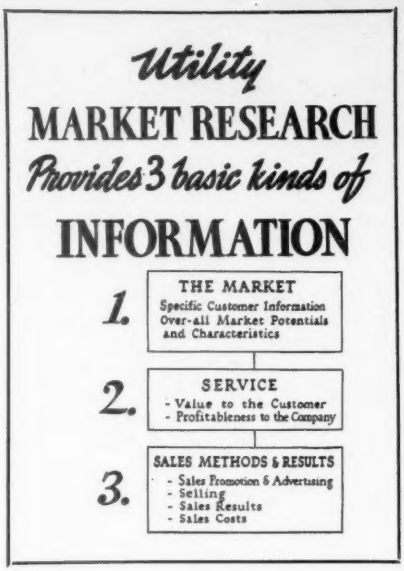

MARKETS
Are Measurable
HOW U.S. FARM FAMILIES SPEND THEIR MONEY*
COSMETICS
Percent use by age of purchaser*
Office Equipment Buying Power Index Checked Against
COMBINED SALES OF FIVE REPRESENTATIVE COMPANIES

The first is a study recently conducted by the United States Department of Agriculture to determine how *United States Farm Families Spend Their Money.* The survey found that approximately half of the Farm families earn over one thousand dollars a year, while the other half earn under one thousand dollars a year. It also found out that that half of the Farm families which earn over one thousand dollars a year account for 81 per cent of all Farm money spent on housing; 75 per cent of all automobiles purchased by Farm families; 74 per cent of all Farm income for household furnishings; and 70 per cent of the money which farmers spend for household operation. One example of how markets can be measured.

The second example summarizes an *Analysis of 43 Classifications of Products Showing the Per Cent Use by Various Income Groups.* It shows some rather interesting conditions. For instance, the first comparison is between Baby Powder, Beer, and Bird Seed. Baby Powder is found to be primarily a low-income commodity. More of it is purchased in the $20 to $39 a week income group than in any other group. The beer drinkers, on the other hand, are a little further up the income ladder, the largest purchases here being in the $40 to $59 income bracket. Bird Seed, on the other hand, is a luxury item, preferred for the most part in the $80 and over a week group. Here is another similar comparison—Diapers and Dog Food. Diapers are primarily a low-income commodity. Twice as many diapers are purchased by the lowest income group, for instance, than are purchased by the highest income group. Dog Food, on the other hand, appears to be another luxury item. And so it goes with a number of other items. — Another example of how markets can be measured, this time by income groups.

As a third example, a group of magazines desired to find out how various cosmetics are used by different age groups. The survey showed that face powder and hand lotion are used pretty much by all age groups. Lip stick and mascara, on the other hand, are preferred primarily by the younger women, while nourishing creams and toilet waters are the favorites of the older ladies. Yet another indication of how markets and buying habits can be measured, this time by age groups.

The fourth and last illustration is perhaps the most interesting of all. A group of five large office equipment manufacturers decided to find out if there was any scientific way in which they could budget future sales of their products in major sales territories throughout the United States. After some study they found a group of indices which appeared to provide a sound basis for prognosticating sales of office equipment. As a result of this market study they set their budgets, as shown by the dotted line on the chart. Each of the vertical lines represents one sales area. A year later when they had actual sales figures they plotted them to the same scale, and it is most gratifying to see how close the actual results came to their budget estimates.



Now none of these four examples has anything to do with the utility business and their findings won't be helpful in any way to the utility sales manager. The important point, however, is that while the findings don't apply, *the method whereby those findings were secured do apply.* If the same sort of scientific effort employed in these surveys is used to study utility markets and utility customers, it can secure a lot of valuable, factual information. When applied to utility markets: *Utility market research provides 3 basic kinds of information*

—Information about the market
—Information about the service
—Information about sales methods and results

With respect to the market, it provides specific customer information such as prospects for increased use of service, customer attitudes and desires, customer habits of using utility ser-

Who Should Be RESPONSIBLE *for Getting that Information?*

THE SALES DEPARTMENT

vice, and standards of living. In addition, it provides factual information concerning over-all market potentials and characteristics, basic territorial trends, and new uses for utility service.

With respect to the company's service, it provides a systematic program for gathering information concerning the value of each service to the customer and the profitableness of each service and combination of services to the company.

When it comes to sales methods and results, Market Research provides an almost limitless amount of information. It reveals the best advertising appeals and presents information on advertising effectiveness. It shows how salesmen are using their time, how much of it they spend face to face with the customer, and how much is used up in traveling and office work. It throws light upon the sales effectiveness of individual salesmen and individual sales territories. And last but not least, by providing a more accurate basis of evaluating sales potentials it makes possible a much more realistic evaluation of sales results.

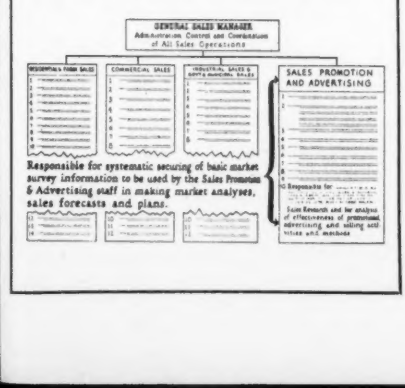
Naturally the question arises as to *who should be responsible for getting that information?*

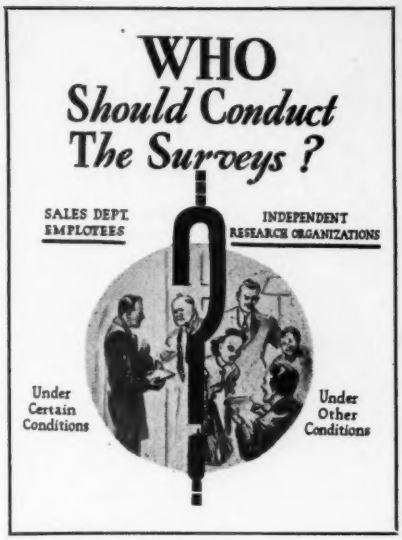
Obviously the answer is the Sales Department, more particularly, the Sales Promotion and Advertising Division.

There is shown a functionally correct Sales Department organization chart which is being used by most Ebasco client companies.

It is divided into four major divisions—the Sales Promotion & Advertising Division; Residential & Farm Sales Division; Commercial Sales Division; and the Industrial Sales and Government & Municipal Sales Division. The first division, the Sales Promotion & Advertising Division, shown on the right of this chart, is directly responsible for all phases of the Market Research Program. You will note that I have used the word "responsible." That does not necessarily mean that the Sales Promotion and Advertising Division will do all of the work with its own personnel. If extensive surveys are needed it may be necessary to get outside help, either from the other three divisions of the Sales Department or from outside Market Research organizations. The next question which arises is: *Who should conduct the surveys* if and when the surveys are needed? The answer as indicated by the chart is that Sales Department Employees should conduct the surveys under certain conditions and independent research organizations should be used under other conditions.

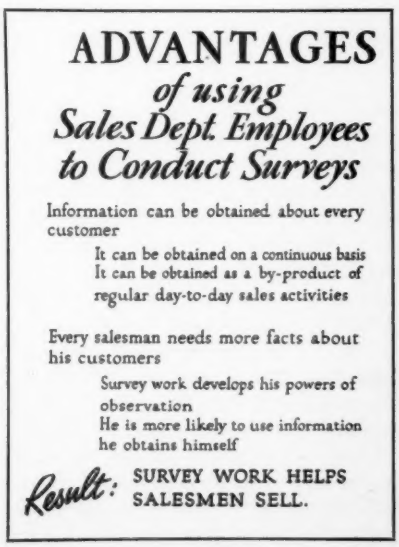
Sales Department Employees should be used to conduct surveys only when that information which is desired can be secured as a by-product of their day-to-day sales activities—only if they actually need such information to help them do a better sales job. Beyond that point, when other data are desired or when it is necessary to make a particularly difficult survey such as one which attempts to evaluate people's opinions or the reasons for those opinions, then it will almost always be advisable to use the services of an experienced outside research organization.


THE
SALES
DEPARTMENT
GENERAL SALES MANAGER
Administration, Control and Coordination of All Sales Operations
COMMERCIAL SALES
SALES PROMOTION AND ADVERTISING
Responsible for systematic securing of basic market survey information to be used by the Sales Promotion & Advertising staff in making market analyses, sales forecasts and plans.



The advantages of using sales department employees to conduct surveys are many. For instance, if the company's salesmen are used, information can be obtained about every customer. This is something that for cost reasons can rarely be done when an outside agency is used. Furthermore, as has been pointed out, such information can be obtained on a continuous basis as a by-product of regular day-to-day sales activities.

Nobody knows better than the utility sales manager that every salesman needs more facts about his customers. Survey work has the added advantage of helping the salesman develop his powers of observation, and he is more likely to use information which he obtains himself. The net result is that


ADVANTAGES
of using
Sales Dept. Employees
to Conduct Surveys
Information can be obtained about every customer
It can be obtained on a continuous basis
It can be obtained as a by-product of regular day-to-day sales activities
Every salesman needs more facts about his customers
Survey work develops his powers of observation
He is more likely to use information he obtains himself
Result: SURVEY WORK HELPS SALESMEN SELL.

survey work, if properly conducted, actually helps the salesman sell.

But let's not forget that in spite of these many advantages *the utility salesman's job is to sell his company's service.* First, last, and all the time, that is his job, and under no circumstances should he be burdened with a lot of fact gathering which will not help him in his primary function.

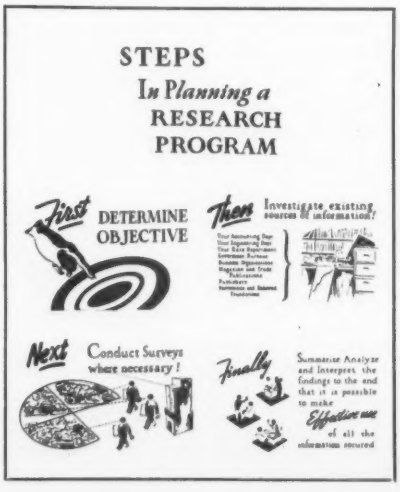
The advantages of using outside market research agencies are also numerous and important. Oddly enough, the advantages are similar to those used by utility Industrial and Commercial salesmen in selling utility serivce. For instance, when an outside agency is used the total cost is known in advance and the agency brings with it trained and experienced personnel with an impartial and objective viewpoint. Furthermore, when hard cash is paid on the barrel head it is more likely that the scope of the survey will be held to actual requirements. There won't be any wandering around or gathering a lot of interesting but useless information. An outside agency usually also brings with it a staff capable of completing the work in a minimum of time and provides a certain prestige value with regard to the information which it collects and the interpretation placed upon that information. Since the ultimate objective is to get the findings used, the prestige value is often a significant item.

Let's look for a moment at the *steps in planning a research program.*

First, and so obvious it hardly needs mentioning, is to determine the objective of the program. It is safe to say that no research effort can succeed without clear-cut and practical objectives. Once it is known exactly what information is desired and in what period of time it must be secured, the next step is to investigate existing sources of information; in short, to see if the information has already been secured by somebody else. Obviously, if it has, there is no need to duplicate expenditure of effort or money.

The first place to seek such information is right within your own company. Perhaps your Accounting Department or your Engineering or Rate Departments will already have secured the very facts which you are seeking. If so, these are the easiest places from which to secure it. If the desired data are not forthcoming from within your own company there are a lot of other splendid sources of existing market and sales information. Government Bureaus, particularly the Department of Commerce, are excellent sources. Other business organizations, magazine and trade publications, publishers, universities, and endowed foundations, are all worth considering.

If the facts are not forthcoming from such existing sources of information, then it becomes necessary to conduct a survey. This can be done in one of two ways: either by complete coverage, or by sampling. If information is needed concerning individual customers, then it becomes necessary to go out and contact those individual customers. If, on the other hand, the objective is to secure information which reveals certain conditions with regard to groups of customers, rather than individual customers, then this can be done by the so-called sampling method. I won't attempt to go into the details of scientific sampling. There are several good treatises on the subject, which will tell you all you need to know.



ADVANTAGES *of using* Market Research Agencies

- Total cost is known in advance
- Trained and experienced personnel
- Impartial and objective viewpoint
- Scope of survey held to requirements
- Ample staff to complete work in minimum time.
- Prestige value of information and interpretation.

Finally, regardless of how the information is secured, it must be summarized, analyzed, and interpreted to the end that it is possible to make effective use of all the information secured.

And that brings up another important point. So far, most of the Market Research work carried on in the utility industry has had to do with the collection of data rather than with the summarization and use of those data.

There are two broad uses of Market Research information. Either it can be used by the salesmen in their day-to-day work with customers or it can be used by the Sales Promotion and Advertising Department in sales planning, making budgets, setting quotas, and generally directing sales effort where such effort is most needed. Obviously, this latter function can only be carried out if the underlying information has been processed and made available in summarized form.

The biggest single need now is to organize the facts which are already being secured as a by-product of the day-to-day sales activities. We have tried to dramatize that idea on the chart by comparing the process with the function of a thrashing machine.

The wheat on the wagon represents the raw facts which are brought in by the salesmen. The thrashing machine takes this wheat and separates the chaff from the kernels. There goes the chaff

out to the right of the machine. It includes all the guesswork, the "I'll Betchas," the precedents, the unsound ideas, and the erroneous opinions. The sound conclusions, wheat kernels in this case, are pulled out where they can be understood and used effectively. A processing procedure similar to this is the biggest single need now with respect to utility Market Research.

If these steps are taken, *market research can help you.*

It can help you in a number of ways. It can help you improve sales planning, bring about better customer relations, stimulate dealer cooperation, and increase the effectiveness of your Sales Promotion and Advertising. And it can help you help your salesmen make better use of their time.

Since Market Research can do all of these things, *let's put it to work now!* Let's begin to use it in an organized way

—To reveal basic changes in your local market

—To locate new sales opportunities

MARKET RESEARCH *Can Help You-*

- Improve sales planning
- Bring about better customer relations
- Stimulate Dealer Coordination
- Increase effectiveness of Sales Promotion and Advertising.
- Help salesmen make better use of their time.
- Evaluate Sales Results

PUT
Market Research
TO WORK Now-
AND
Use it
— To reveal basic changes in your local market
— To locate new sales opportunities
— To simplify sales methods
— To eliminate unsound specialization and misdirected emphasis
— To make sales more profitable to both company and customer
All FOR BIGGER AND BETTER Sales!

—To simplify sales methods

—To eliminate unsound specialization and misdirected emphasis

—To make sales more profitable to both company and customer

In short, let's use Market Research to take the guesswork out of selling. Base every sales decision on facts provided by Market Research, and thereby put into effect the laudable sales principle of "Determining Your Sales Destination Before You Buy Your Sales Ticket."

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300 Utility Men Attend G-E Sales Conference

MORE than 300 operating and sales executives of electric service companies from all over the country assembled in the General Electric Company's new Institute at Bridgeport, Conn., on Jan. 4 and 5, for a sales conference sponsored by the G-E appliance and merchandise department.

Lighting, appliance, financing, dealer cooperative programs, adequate wiring, revenue problems, new home construction, rural electrification, load building, and various phases of the electric range business highlighted the program, which was addressed by several utility men directly, and by several more indirectly during the discussions and open forums. Charles E. Wilson, newly elected president of the General Electric Company, spoke to the group at the annual dinner held at the Stratfield Hotel, Bridgeport, on the first evening. Lawrence Jennings, eastern manager of G-E appliance sales to utility companies, acted as chairman for both daytime sessions.

The conference was devoted strictly to utility appliance merchandising problems, the majority of the speakers being drawn from outside the General Electic Company. H. L. Andrews, G-E vice-president in charge of all appliance operations, welcomed the visitors of the first day as official host, while C. M. Snyder summed up the two days' proceedings at the close. A. L. Scaife presented the company's plans and promotions for 1940 revolving about the "It's Easy To Stay Young Electrically" theme. C. W. Stuart discussed new revenues available in new home construction, and H. F. Barnes and Charles W. Appleton, vice-president, completed the roster of G-E men on the program.

Among the principal speakers during the two days were Austin Monty, residential sales manager of the Philadelphia Electric Co.; Leslie Weiss of the Utility Management Corp.; J. M. Stedman, residential sales manager of the Pennsylvania Power and Light Co.; Edwin Vennard, vice-president of Middle West Service Co.; R. L. Burgan, director of rural development of the New York State Electric and Gas Co.; Walter Sammis, vice-president of Commonwealth and Southern Corp.; V. H. Moon, vice-president of Central Service Corp.; C. W. Leihy, editor of *Electric Light and Power*, and A. T. Littlefield, sales manager of Central Maine Power Co. Special trains from Boston and New York brought the visitors to Bridgeport, in such numbers that the hotel facilities were somewhat overtaxed.

Disposition of Amounts in "Acquisition Adjustments" and "Plant Adjustments" Accounts

By C. F. MacRae
Whitman, Ransom, Coulson & Goetz

An address before the Third National Accounting Conference Edison Electric Institute, Chicago, Illinois, November 13, 1939

THE work of compliance with the original cost provisions of the new accounting classifications is now virtually completed, and the dollars of original cost rest in the detailed plant accounts, more or less assured of recognition as assets of value. The difference between the original cost and the actual cost of utility plant is not so fortunately situated. It is lodged somewhat insecurely in an adjustment account, provisionally classified as an asset, but subject at any time to be haled into commission or court to prove its worth or be ejected.

Little novelty remains in the theory of original cost, but the necessity for considering the disposition of the amounts recorded in the adjustment account raises many new and interesting problems of practical application in concrete form and upon a very large scale.

As a starting point for general discussion of these problems, I want to outline in a very general way a few fundamental principles which I believe should be kept in mind.

In the earliest conception of the original cost theory there was a tendency to confuse "disposition" with "dispossession". This tendency was curbed in 1935, when the New York courts annulled a classification of accounts which required, in effect, that the excess of original cost over book cost be written off against surplus, without further ado[1].

The adjustment machinery provided by the present classifications of accounts was approved by the Supreme Court of the United States, in the Telephone Accounting Case[2], largely because the Court felt that an administrative interpretation furnished by the Federal Communications Commission provided an adequate safeguard against the application of the original cost provisions in a confiscatory manner.

The Federal Communications Commission was committed by this interpretation to the proposition (1) that amounts included in the adjustment account which were deemed "after a fair consideration of all the circumstances, to represent an investment the accounting company has made in assets of continuing value" will be retained in that account until such assets cease to exist or are retired, and (2) that such assets as are definitely attributable to depreciable plant will be amortized through charges to operating expenses.

Virtually all of the "new" classifications became effective after the Telephone Accounting Case was decided by the Supreme Court in December, 1936. Consequently the limitation indicated by the Telephone Case must be read into the new classifications.

Although the broad features of the original cost adjustment machinery are the same, some variations appear among the several systems. The F.P.C. and N.A.R.U.C. Classifications, one or the other of which has been adopted by most of the state commissions, embody two Adjustment Accounts: Account 100.5, Plant Acquisition Adjustments, which is restricted to differences between book cost and original cost of plant acquired as an operating unit or system, and Account 107, Plant Adjustments, which is a catchall for write-ups and other differences between book cost and original cost "not clearly includible in any other account" (Plant Account Instruction 2 (c)).

The New York Classification and the Telephone Classification each provides only one Adjustment Account, which performs the same functions as the two accounts in the F.P.C. and the N.A.R.U.C. Classifications.

There are also variations in the phraseology of the directions for disposition in the several classifications. The F.P.C. and N.A.R.U.C. Classifications provide that amounts recorded in the Plant Acquisition Adjustment Accounts "shall be depreciated, amortized, or otherwise disposed of, as the Commission may approve or direct"[3], and embody a further requirement for obtaining the order or approval of the Commission before charging amortization of adjustment items to operating expenses[4]. The New York Classification merely requires that the Commission be notified as to the utility's "program for depreciation, amortization, or other disposition"[5], but like the F.P.C. and N.A.R.U.C. Classifications, it imposes a further requirement that the Commission's approval be obtained to the amortization of adjustment items through charges to operating expenses[6].

On close analysis, all of these variations among the several classifications seem to be matters of form rather than substance. It is doubtful that the original cost provisions of any of the classifications diverge from the F.C.C. Classification in such a substantial manner as to require a different result than that reached by the Supreme Court in the Telephone Case. Consequently, it appears that the adjustment machinery has come to stay. (Unless it breaks down when it starts to grind.)

Generally speaking, there are no express requirements or time limitations for formally presenting the adjustment account for Commission examination and approval.

The Federal Power Commission has recently issued a general order[7] relating to disposition procedure which has been approved by the N.A.R.U.C. and

[1] *The New York Edison Co.* v. *Maltbie*, 244 App. Div. 685, aff'd 271 N. Y. 103.
[2] *American Tel. & Tel. Co.* v. *United States*, 299 U. S. 232.
[3] Account 105, Subd. C.
[4] Account 505, Subd. A.
[5] Account 105, Subd. E.
[6] Account 505, Subd. A.
[7] F.P.C. Order No. 42-A, July 11, 1939.

recommended for adoption by the State Commission[8]. The order provides in effect (1) that debit acquisition adjustment items may be charged off against earned surplus without further order[9]; (2) that the authorization of the Commission be obtained for any other method of accounting for such debit items; (3) that credit items shall be accounted for as directed by the Commission; and (4) that credit items shall not be netted against debit items. This order leaves the initiative with the utilities as before.

There are two considerations which tend to impel the utilities to take the initiative in the disposition of adjustment items. First, a desire to amortize or depreciate adjustment items which are identified with depreciable plant; and second, a desire to clearup the somewhat equivocal status of adjustment items as provisional assets. If the utilities do not proceed voluntarily in the near future, it is likely that the Commissions will commence general proceedings on their own initiative.

Since the Commissions will have to pass upon the disposition of most of the adjustment items, the question naturally arises as to the scope of their power in the matter. Regulatory jurisdiction over accounting matters is, of course, derived from statute. The Federal Power Commission, for example, has statutory authority to (1) prescribe a system of accounts, (2) to examine the accounts, and (3) to determine by order after a hearing the propriety of entries in the accounts. At any such hearing the (4) burden is upon the utility to establish the correctness of the entries[10]. The Federal Communications Commission, whose classification was before the Supreme Court in the Telephone Accounting case, has similar statutory jurisdiction, and so do most of the state commissions.

Since the source of the Commissions' jurisdiction in accounting matters is statutory, it follows as a fundamental proposition that the scope of their power has not been altered by the new classifications of accounts.

Although the bounds of accounting jurisdiction are marked out in broad terms in the statutes, the statutes do not afford the precision of definition which is needed in dealing with the practicalities of the adjustments disposition problem. The opinions of the Courts shed some light upon the matter, although there are not many recent cases directly in point.

In the Telephone Accounting Case the Supreme Court emphasized that the purposes for which an accounting classification is designed must always be kept in mind when considering the reasonableness of regulations imposed. The Court said that the object of an accounting classification was not to enable regulatory authorities to regulate affairs over which they have jurisdiction, but to afford information as to the business methods of the utilities so that the regulatory authorities may properly regulate such matters as are within their jurisdiction.

The opinion of the Court in the Telephone Case also provides the outlines of a practical scale for gaging the extent to which Commissions may go in requiring disposition of adjustment items by write-off. (The Court specifically held that the write-off of an item which represents "a true increment of value" cannot be required, but clearly implied that write-off of "fictitious or paper increments" will be upheld.)

These terms are not sufficiently definite to permit of ready classification of the numerous variables encountered in the acquisition of adjustments account, but they are much more satisfactory than the language of the statutes.

Three other recent New York cases help to bring the language of the Supreme Court into sharper focus.

In the Iroquois Gas case [11] decided in 1934 the Commission had approved the acquisition of a gas plant at a price of $130,000, but had coupled its approval with the condition that the gas company write-off to surplus the amount of $40,000, representing the excess of purchase price over original cost depreciated, as found by the Commission. The New York Court of Appeals reversed the order of the Commission, holding that the Commission might properly have conditioned its assent to the acquisition upon a change in the terms of the contract of purchase, but that it could not couple its consent with a condition which it had no independent power to impose, namely, the condition that the company charge off the acquisition adjustment element to surplus. The Court said (p. 21):

"* * * The power vested in the Commission to prescribe uniform methods of keeping accounts and records does not include the power to compel a corporation to write off from its book value a loss which it has not sustained, or to give up a part of its constitutional rights."

In the more recent Lockport case[12], decided in May, 1939, the Appellate Division of the New York Supreme Court followed the doctrine enunciated by the Court of Appeals in the Syracuse Gas case, and held that the Commission did not have the power to require the write-off of the excess of a purchase price—which the Commission had previously approved—over original cost depreciated, even though the officers of the purchasing utility had agreed in advance to a condition, embodied in the Commission's approval of the purchase, that the accounting entries would be based on original cost depreciated, subsequently to be determined by the Commission. On the latter point, the Court said:

"* * * The power of the Commission was not increased through the acceptance of the conditional order by the vice-presidents of petitioners. Property and constitutional rights could not be destroyed, abrogated or waived by the corporate officials."

The third case, N. Y. State Electric and Gas Corporation v. Maltbie [13] decided in 1935, casts considerable light upon the "paper increment" end of the scale. In that case, an operating property which had been acquired by a utility in an arms length transaction at a cost of approximately $2,270,000 was transferred to an affiliated utility and recorded on the books of the latter at $6,500,000. The Court upheld an order of the Commission requiring that the difference between $2,270,000 and $6,500,000 be written off, stressing the point that there had been no proof of value greater than $2,270,000 at the time of transfer.

Where a particular item will fall on this somewhat unsatisfactory scale, marked "paper increment" on one end and "true increment of value" on the other, naturally depends on the facts. Let us take the debit acquisition adjustment item[14]: The most significant

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[8] Resolution adopted August 25, 1939.

[9] Cf. Securities and Exchange Commission, Accounting Series Release No. 1 Re Monongahela West Penn Public Service Company and American Water Works and Electric Company, Incorporated, File No. 43-119 (Holding Company Act Release No. 1377; decided December 21, 1938). Re Columbia Gas and Electric Corporation, File No. 43-160 (Holding Company Act Release No. 1417; decided January 25, 1939). Re The North American Company, North American Edison Company, File No. 54-10 (Holding Company Act Release No. 1427, decided January 30, 1939). Re New York and Richmond Gas Company, File No. 43-175 (Holding Company Act Release No. 1442); decided February 16, 1939) and Re The United Corporation, File No. 63-1 (Holding Company Act Release No. 1467, decided March 13, 1939).

[10] Federal Power Act, Sec. 301.

[11] *Iroquois Gas Corporation* v. *P. S. C.*, 264 N. Y. 17 rev'g 238 App. Div. 184 (1934).

[12] *Lockport Light, Heat and Power Company* v. *Maltbie*, App. Div. (Third Dept., dec'd May 10, 1939).

[13] 243 App. Div. 655 (Third Dept., 1935); leave to appeal denied, 267 N. Y. xxxix.

[14] i.e., excess of book cost over original cost depreciated of property acquired as an operating unit or system.

facts which should be considered in gaging the worth of this item are:

1. Relationship of the aboriginal owner to the present owner—were the parties affiliates, affinities, or strangers?
2. Value at time of acquisition by present owner—was it equal to or less than the price paid?
3. Prior regulatory treatment—has the Commission approved the purchase price, or approved the issuance of securities against the purchase price? Has the full purchase price been recognized in rate cases?

Naturally the inter-play of these facts will ultimately determine the reality of the asset. Close relationship between the aboriginal and the present owner is not necessarily fatal. It unquestionably increases the burden upon the utility to establish the value of the asset, but the burden might be sustained by convincing evidence of value at time of acquisition. To continue up the scale, strong evidence of value at time of acquisition may not be essential if Commission approval of the purchase price or of the issuance of securities against the purchase price can be shown. In the New York Accounting case, the Court stressed the latter factors, saying[15]:

"* * * Many of the fixed capital accounts ordered to be redistributed contain entries reflecting purchases from predecessor utilities that were approved by the commission and other entries concerning consolidation and purchases which have been approved by Courts, including the Supreme Court of the United States. These entries are not made upon the basis of 'original cost' as the commission now seeks to define it. Financing has been carried on and transactions made on the basis of these figures as to fixed capital. A requirement that a part now be charged off is confiscatory."

When we come to the credit acquisition adjustment items, the yardstick which we have developed from the opinions of the Courts has little usefulness, because the very same facts which would establish an isolated debit item as a "true increment of value" will conclusively prove that an isolated credit item is a "fictitious or paper increment." I think the solution for this paradox is the netting of credit items against debit items. I can perceive no sound consideration for isolating the debit and credit items in the adjustment account that would not be as well subserved by adequate memoranda supporting the entries.

I have no suggestion as to what should be done when the entire adjustment account shows a net credit balance. Such a result indicates, of course, that the detailed plant accounts have been written up under compulsion of regulatory authority. In my judgment, it is beyond the bounds of regulatory power to compel a continuance of such a situation.

[15] 244 App. Div. 685 at 690.

Let us apply our scale to another item—the write-up—which is specifically mentioned in the F.P.C. Plant Adjustment Account. What facts can be shown to establish the write-up as an asset? This item has been given a very bad name, which is likely to drag it to an early grave. As a practical matter, I believe that the very strongest support—possibly express Commission approval of financing based upon the write-up—will be required in order to establish that it is a "true increment of value."

We next come to a miscellany of adjustment items which almost defy classification. In the acquisition adjustment accounts of some of the utilities subject to the N. Y. State Classification will be found items relating to property not acquired as an operating unit or system. This condition results from the fact that the original cost provisions of the New York Classification apply to all property, whether acquired as an operating unit or system or otherwise. Generally speaking, these items represent arms-length, open market transactions, and their retention as assets of value may readily be defended.

There are also included in this miscellany credit or debit items resulting from the necessity of estimating the original cost of plant. Previously uncapitalized charges are unavoidably reflected in these items, but that is more properly considered as a phase of the determination of original cost than as a phase of disposition of adjustment items. In this connection, I would like to call your attention to the Wellsville Case, decided by N. Y. App. Div. on Nov. 1, 1939, which indicates that the inclusion in original cost of amounts which might have been charged to operating expense when incurred is by no means foreclosed by the new account classification.

Ultimately, we come to a residuum of items in the Adjustment Accounts which should never have been placed there, and would not have been placed there except for the exigencies of compliance with the requirements of the new classifications of accounts within a very rigid time schedule. For tactical reasons, if for no other, these items should be cleared out as soon as is practicable.

In this connection, I should like to say, that while most of the acquisition adjustment items are worthy of the most vigorous defense, there are unquestionably a number of moss-grown relics in the adjustment accounts which have been permitted to edge their way over from the old unclassified fixed capital account, or from some of the old intangible accounts, merely because they have withstood repeated assault in prior litigation. Perhaps it would be good accounting, as well as good policy and tactics, to do a little weeding, in order to prevent the jimson-weeds from choking out the petunias.

The procedural phase of disposition presents a problem which needs to be solved at the outset: Is it better to bring up the adjustment items for regulatory review in a piecemeal, or in a wholesale fashion? There are considerations on both sides. If the whole account is brought up in one proceeding, there is a fair prospect for obtaining the advantage of netting credit items against debit items, whereas if the items are reviewed one by one in separate proceedings, there is danger of being whipsawed. On the other hand, under a piecemeal procedure, it will be possible to put the best foot forward and make valuable precedent. This is a question that is worthy of serious consideration, for tactics will mean a lot in this battle.

In confining my remarks to the initial phase of disposition—the process of sorting out the "assets of continuing value"—I do not wish to minimize the problems of the succeeding phase—the process of amortizing or depreciating the items that survive the winnowing. I leave the second phase for later discussion.

Course for Appliance Salesmen

THE need of better trained sales people both in the utility and dealer fields is ever present in our load building processes. It is therefore of interest to learn of the availability of a training course offered through Electric Appliance Selling Institute of which Mr. Roy Thurman is president. Mr. Thurman has had experience in the electric manufacturing field, and for the past decade has been affiliated with Indianapolis Power and Light Company as commercial manager and as director of commercial appliance sales.

This home study course includes eighteen lessons. Complete information may be received by writing to Mr. Thurman, Electric Appliance Selling Institute, 315 Murphy Building, Indianapolis, Ind.

An Asymptotic Method of Determining Annual and Accrued Depreciation

By Joseph Jeming
Maurice R. Scharff, Consulting Engineer, New York

From a paper presented before the Third National Accounting Conference, E.E.I., Chicago, Nov. 13-15, 1939

DEPRECIATION is a subject of major importance in the conduct of business. The close regulation to which public utilities are subject makes the proper treatment of depreciation of particular interest to them.

Accountants have devoted a great deal of time to the subject since depreciation is important in the preparation of financial statements. Engineers have made significant contributions to the problem, especially while engaged in the determination of "fair value" for public utility rate making. Economists have studied the problem by approaching it from the standpoint of economic value, while statisticians have attacked it mathematically.

The ample literature[1] on the subject makes it unnecessary to dwell at length upon the various methods of treating depreciation. In recent years, the straight-line[2] theory, which depends basically on estimates of probable service life, has been finding somewhat wide acceptance.[3]

It is the purpose here to suggest a new way of estimating annual and accrued depreciation which will overcome some of the limitations of existing methods. The main object of this paper is the construction of a workable method of calculating depreciation so as to absorb the net retirement losses in terms of original investment over the useful life of the property which it represents. The basic considerations which govern the development of this proposed method are stated below.

1. The data required for proper application of the method must be easily available.
2. The volume of calculation should not be excessive nor too complex for practical application.
3. The assumptions implicit in the theory are not to be at variance with experience.
4. It must be possible to support the results empirically by comparison with the results obtained by other methods and in the light of experience.

The most important limitation upon any method of determining average service life is the lack of basic data. There are available, in almost all cases, figures representing the dollars of investment in classes of associated units of property which sometimes form fairly homogeneous groups. The figures reflect by years, over the history of the enterprise, the additions to investment, the retirements from the investment, and the investment balances at the beginning and end of each calendar year. The proposed method is based upon the utilization of these basic data for the development of the annual rates of depreciation.

The theory of this method is predicated upon the postulate that in the case of a homogeneous group of units of property, where the total number of units is kept constant, the ratio of retirements to the total in the group will approach some constant level.[4] Similarly, the ratio of additions or replacements to the total will approach the same limiting value. This is self-evident since in the case of a stable total, the replacements must be equal to the retirements. The limit of these annual ratios, which may be termed the retirement ratios and the addition ratios respectively, is equal to the reciprocal of average service life.[5] Thus, the limit is the annual depreciation rate required for depreciation accounting under the straight-line theory of depreciation.

In the case of a class of property represented by a fairly constant investment, the method of determining the average service life of the dollars of investment resolves itself into one of finding the limiting value of the retirement ratios. The average service life of the dollars is used because in accounting the dollars of investment are taken as the criterion rather than the units of property as such.

In order to find the limiting value of the retirement ratio, the observed ratios are fitted using the method suggested by the theory of Least Squares. The function selected must have the property of possessing a limiting value. The simplest of these functions is of the form:

$$R = a+bx^{-1}+cx^{-2}\ldots.$$

where R is the retirement ratio
and x is taken in years as units

The function has several favorable characteristics. It is analogous to an ordinary polynomial. The coefficients may be tested for the significance of their deviations from zero in order to determine objectively the number of terms to be used in fitting. The value of the first coefficient, a, is the desired value of the asymptote, that is the limiting value of the retirement ratios, as x approaches infinity. The estimate of variance of a may be found easily. It is comparatively simple to construct tables of x^{-n} and $S(x^{-n})$ for various ranges of x in years, for the purpose of setting up and solving the normal equations obtained by the Least Squares method.

Of course, it must be noted that the inferences as to the accuracy of the estimates of variance and therefore the reliability of the tests of significance depend upon the assumptions underlying the theory of Least Squares. Of these, an important assumption is that the data used must exhibit independence of their successive residuals from the fitted curve. In the case of public utility retirement ratios, as in the case of most economic data, it is usually difficult to find such independence of suc-

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[1] National Association of Railroad and Utility Commissioners. Report of Special Committee on Depreciation, 1938. Marston and Agg, "Engineering Valuation." McGraw Hill Book Company, 1936. James C. Bonbright, "Valuation of Property." McGraw Hill Book Company, 1937. E. B. Kurtz, "The Science of Valuation and Depreciation." Ronald Press, 1937. W. J. Graham, "Public Utility Valuation." University of Chicago Press, 1934. "Statistical Analyses of Industrial Property Retirements." Bulletin 125, Iowa State College, 1935.

[2] Financial Handbook, Ronald Press, 1937, p. 382.

[3] Re Manchester Street R. Co. P.U.R. 1925D, 486. Michigan Bell Teleph. Co. v. Odell, P.U.R. 1931B, 192, 45 F (2d) 180. Re Citizens Teleph. Co. P.U.R. 1921E, 308. Federal Income Tax Practice—See Treasury Bulletin "F" (1931 ed.)

[4] Re Community Nat. Gas Co. (1936) 15 P.U.R. (N.S.) 149.

[5] Gabriel A. D. Preinreich, "The Practice of Depreciation," Econometrica, July, 1939, P. 259.

cessive residuals. This means that in most cases the procedure used to find the number of terms in the fitted function yields distorted estimates of variance of the coefficients. However, this does not necessarily mean that the method is to be abandoned but that no undue reliance is to be placed on the results in the light of the theory of Least Squares.

Since all curve fitting is subject to errors of forecast, it is helpful to obtain the limiting value from another source which may serve as a check upon the results of the previous calculation. This may be accomplished by fitting the addition ratios by use of the function:

$$A = a' + b'x^{-1} + c'x^{-2} \ldots\ldots$$

where A is the addition ratio

In the case of a stable property, the limiting value of A, which in this case equals a', is equivalent to a previously determined and thus forms a check of the results. This check is particularly helpful in the practical application of the method where static properties are the exception rather than the rule, and the limiting values determined above are merely estimates of the true limits.

In actual practice, public utility property, when taken in terms of units of dollars of investment, often exhibits growth. It is necessary, therefore, to take this factor into account. Growth of the investment or fixed capital balance may be due to either of two causes. The number of physical units of property may vary or the cost of the replacement units may change. Usually both factors play a part in causing growth. For accounting purposes, the dollars of original cost, that is, fixed capital, are to be recovered over the life of the property by charges against income. Under this consideration it is immaterial which factor causes growth of the fixed capital balance if the depreciation study be based on dollar data.

In the case of an increasing fixed capital balance, retirement ratios, for a property possessing a given average service life, are less in absolute value than for a static property. This follows because of the mortality dispersion over a period of years following the addition to fixed capital, which causes a lag in retirements. Similarly, the addition ratios are greater in absolute value. Thus, it follows that the limit of the observed retirement ratios is an underestimate of the true value, whereas, the limit of the addition ratios is an overestimate. Therefore, the true value of the reciprocal of the retirement and replacement ratio must lie between those two limits if it is assumed that conditions which prevailed in the past are representative in the long run.

Under these considerations, the position of the true value of the reciprocal of average service life, d, which must lie between the limit of R and the limit of A, depends on the function of the survivor curve of the property under consideration. This has been proved for several type curves assuming a uniform rate of growth of additions. The type curves used were selected from Bulletin 125, Iowa State College,[6] and adjusted one half year for simplicity of computation.

The use of any of the above mortality functions, in evaluating d, requires an implicit assumption which cannot be made on the basis of the available data. Furthermore, the complexity of most mortality functions makes a general solution for d in terms of a and a' impossible.

A practical solution of the problem may be developed by assuming the necessary conditions, such as a particular survivor function and a uniform rate of growth, which will make a rigid solution possible in some special cases; or by finding an empirical solution which will obviate the necessity of assuming ideal conditions. The main criticism of most other methods of determining average service life is the use of assumptions implicit in the theory which are at variance with the facts. It seems advisable, therefore, to choose the empirical solution which does not require the setting up of ideal conditions.

Averages of the two limiting values of A and R were tested empirically for reasonableness and compared with results obtained by the use of other methods. The geometric mean seemed to yield the best estimates. Above, in an actual case the depreciation rates applicable to the dollars representing related groups of units of property of a large gas company, as developed by actuarial studies and engineering estimates, are compared with the geometric mean of a and a'.

Group	Depreciation Rate Other Methods	$\sqrt{a\,a'}$
Work and Station Structures	.025*	.020
Holders	.017*	.014
General Structures	.020*	.017
Boiler Plant Equipment	.050*	.042
Steam Engines	.050†	.053
Internal Combustion Engines	.038*	.033
Water Gas Sets	.045†	.050
Purification Apparatus	.025*	.048
Accessory Works Equipment	.029*	.027
Mains	.011†	.010
Services	.020†	.014
Meters	.027†	.027

* Based on Engineering Estimates
† Based on Actuarial Study

Note: For a detailed description of the property, see the Uniform System of Accounts, P.S.C., New York.

In developing retirement and addition ratios from original data, a few other considerations are helpful. Usually original data are erratic in character and it has been found helpful to sacrifice some of the independence of the observed ratios by computing ratios of cumulated retirements to cumulated balances and cumulated additions to cumulated balances, over the observed range. The result is similar to the one obtained by a moving average in that the fluctuations in the raw data are minimized before fitting the asymptotic functions. This can be done only in those cases in which the entire history of additions and retirements is available. Should the historical data be available only for the more recent years, it is no longer possible to utilize this refinement of method and the simple retirement and addition ratios have to remain the basis.

It has been found that more reasonable results are obtained by fitting the retirement ratios over the range of observed values beginning with the first point at which the ratio is greater than zero. This conclusion has been reached empirically and is supported by the knowledge that the dearth of retirements in the first few years of the investment history is usually not representative of the mortality dispersion of physical property. The method is now summarized briefly before illustrating it by means of an example taken from its extensive application to public utility properties.

The function $R = a + bx^{-1} + cx^{-2} \ldots\ldots$ is fitted to the retirement ratios by Least Squares.

The function $A = a' + b'x^{-1} + c'x^{-2} \ldots\ldots$ is fitted to the addition ratios.

The estimate of the true value of the reciprocal of average service life, d, is found by the equation:

$$d = \sqrt{a\,a'}$$

$$\text{Average Service Life} = \frac{1}{d}$$

The choice of the number of constants in the asymptotic functions depend on several considerations.

Those functions which result in negative values of a or a' must be eliminated. Those functions containing coefficients

[6] Op. cit.

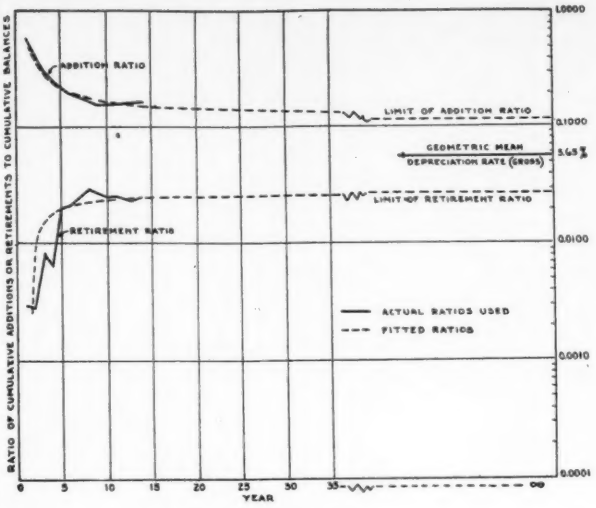


Chart A
Account Nos. 331-342 Outside Plant
(Exclusive of Meters, Meter Installations, and Underground Conduits)
Asymptotic Method

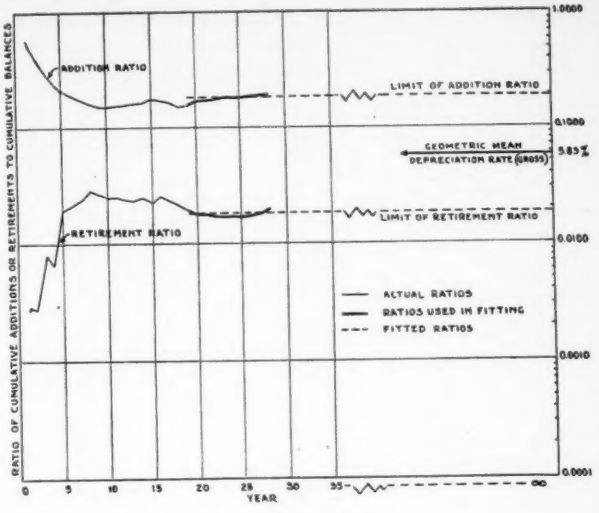


Chart B
Account Nos. 331-342 Outside Plant
(Exclusive of Meters, Meter Installations, and Underground Conduits)
Asymptotic Method

which were not significantly different from zero, under the criterion of t = 2, were not used. The symbol "t" is the ratio of the coefficient to its standard error.

Furthermore, it has not been found practical to use functions containing more than four constants in any event. Usually the above criteria have succeeded in limiting the solution to one value of a and a'. In those cases, however, where more than one value resulted, the values of a and a' nearest each other were chosen since the theory is based on the premise that the two values are equal in the case of a static property.

The rate d is used for the purpose of computing annual depreciation to be credited to the reserve account over the history of the fixed capital account. Since the dollars of retirements are available in the original data, it is a simple matter to build up the reserve for depreciation to the required point in time.

Salvage may be taken care of in the usual manner by adjusting the annual depreciation rate accordingly and crediting the reserve for salvage realized.

In the following illustration of the method, the so-called Outside Plant accounts of a large urban electric company are analyzed. The greater portion of the investment in these associated accounts represents underground and overhead conductors, transformers, poles and

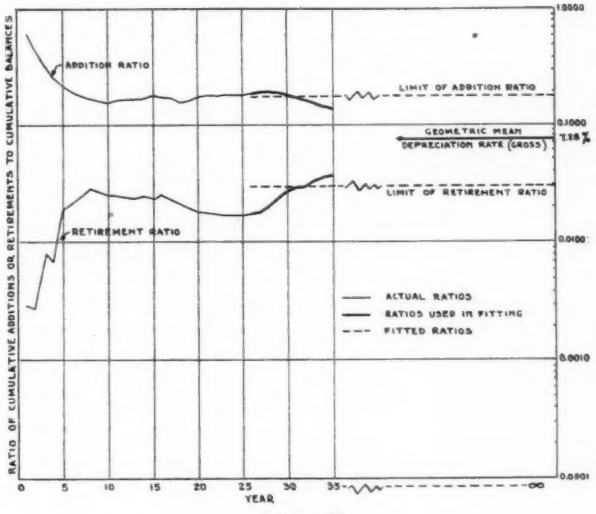


Chart C
Account Nos. 331-342 Outside Plant
(Exclusive of Meters, Meter Installations, and Underground Conduits)
Asymptotic Method

fixtures. The basic data available are shown in Table I.

Table II illustrates the development of cumulative ratios. These are used because the entire history is available and retirements are erratic as indicated in column (4) of Table I.

In building up the reserve for depreciation from the inception of the property, an estimated depreciation rate must be used because no experience is available at the beginning. Therefore, an average life of 20 years and a realizable net salvage of 20% is assumed. This results in the application of a net depreciation rate of 5% x .80 or 4%.

At the end of the 14th year, enough experience has accrued so that the asymptotic method may be used to check the original life estimates. The depreciation

Table I—Basic Data Available from Fixed Capital Record

ACCOUNTS NOS 331-342 - OUTSIDE PLANT
(Exclusive of Meters, Meter Installation and Conduit)

Year (1)	Balance at Beginning of the Year (2)	Additions During The Year (3)	Retirements During The Year (4)	Balance at the End of the Year (5)	Average Balance (6)	Net Retirement Loss During the Year (7)
1900, Aug.1	352,120.80	23,703.69	-	375,824.49	363,972.64	-
1901, Jan.1	375,8 .49	89 287.93	2,341.11	462,771.31	419,297.90	2,341.11
1902	462,771.31	54,588.02	1,435.72	515,953.61	489,362.46	1,435.72
1903	515,953.61	23,229.11	11,046.81	528,135.91	522,044.76	11,046.81
1904	528,135.91	22,627.92	421.29	550,342.54	539,239.22	421.29
1905	550,342.54	37,641.58	41,566.34	546,417.78	548,380.16	41,566.34
1906	546,417.78	58,479.57	19,057.78	585,839.57	566,128.68	19,057.78
1907	585,839.57	56,621.39	24,129.97	618,330.99	602,085.28	24,129.97
1908	618,330.99	64,705.75	36,492.17	646,604.57	632,467.78	36,492.17
1909	646,604.57	71,117.45	12,314.13	705,407.89	676,006.23	10,572.89
1910	705,407.89	114,893.43	9,065.25	811,236.07	758,321.98	6,239.57
1911	811,236.07	168,359.91	22,384.13	956,911.85	884,073.96	20,459.53
1912	956,911.85	174,857.45	18,795.51	1,112,973.79	1,034,942.82	16,667.60
1913	1,112,973.79	255,733.35	23,507.13	1,345,200.01	1,229,086.90	19,386.19
1914	1,345,200.01	237,155.74	53,399.99	1,528,955.76	1,437,077.88	46,224.54
1915	1,528,955.76	493,037.87	17,873.21	2,004,120.42	1,766,538.09	15,379.74
1916	2,004,120.42	324,487.31	95,389.38	2,233,218.35	2,118,669.39	69,766.12
1917	2 233,218.35	312,154.54	21,119.34	2,524,253.55	2,378,735.95	17,419.85
1918	2,524,253.55	205,315.91	13,498.32	2,716,771.44	2,620,162.50	5,231.14
1919	2,716,771.44	517,549.79	24,535.91	3,209,085.32	2,962,578.38	14,903.78
1920	3,209,085.32	1,041,593.44	27,323.30	4,223,355.46	3,716,220.39	17,424.14
1921	4,223,355.46	976,044.82	96,406.65	5,102,993.63	4,663,174.54	69,285.31
1922	5,102,993.63	1 055,451.05	82,264.98	6,076,179.70	5,589,586.67	57,746.23
1923	6,076,179.70	1,320,671.14	114,682.21	7,282,168.63	6,679,174.16	97,692.01
1924	7,282,168.63	1,471,242.13	143,723.24	8,609,687.52	7,945,928.08	113,362.83
1925	8,609,687.52	2,001,328.92	148,533.88	10,462,482.56	9,536,085.04	116,142.42
1926	10,462,482.56	2,485,806.46	232,699.68	12,715,589.34	11,589,035.95	187,734.52
1927	12,715,589.34	3,171,087.52	283,645.06	15,603,031.80	14,159,310.57	239,839.92
1928	15,603,031.80	3,507,331.19	561,826.42	18,548,536.57	17,075,784.18	461,250.72
1929	18,548,536.57	4,604,576.48	913,059.94	22,240,053.11	20,394,294.84	766,794.98
1930	22,240,053.11	3,600,017.50	1,173,377.15	24,666,993.46	23,453,523.28	1,078,934.79
1931	24,666,993.46	2,840,478.29	1,145,684.92	26,361,786.83	25,514,390.14	1,056,918.84
1932	26,361,786.83	3,895,536.82	963,281.04	29,294,012.61	27,827,899.72	848,656.42
1933	29,294,012.61	2 762,806.19	1,871,270.57	30,185,548.23	29,739,780.42	1,187,813.37
1934	30,185,548.23	2,493,377.58	1,891,154.38	30,787,471.43	30,486,509.83	1,163,028.26
1935	30,787,471.43	3,836,069.57	1,512,344.43	33,111,496.57	31,949,484.00	1,278,795.13
1936	33,111,496.57	3,494,825.65	1,412,293.06	35,194,029.16	34,152,762.86	1,115,517.47
1937	35,194,029.16	2,854,383.64	960,712.49	37,087,700.31	36,140,864.74	692,838.37
1938	37,087,700.31					

Table II—Computation of Cumulative Ratios

CUMULATIVE ADDITIONS TO CUMULATED AVERAGE BALANCES
CUMULATIVE RETIREMENTS TO CUMULATIVE AVERAGE BALANCES

Year	X (1)	Cumulative Average Balance (2)	Cumulative Additions (3)	Cumulative Retirements (4)	A Cumulative Addition Ratio (5)	R Cumulative Retirement Ratio (6)
1900	-	363,972.64	375,824.49	-		
1901	1	783,270.54	465 112.42	2,341.11	.5938	.0030
1902	2	1,272,633.00	519,700.44	3,746.83	.4084	.0029
1903	3	1,794,677.76	542,929.55	14,793.64	.3025	.0082
1904	4	2,333,916.98	565,557.47	15,214.93	.2423	.0065
1905	5	2,882,297.14	603,199.05	56,781.27	.2093	.0197
1906	6	3,448,425.82	661,678.62	75,839.05	.1919	.0220
1907	7	4,050,511.10	718,300.01	99,969.02	.1773	.0247
1908	8	4,682,978.88	783,965.76	136,461.19	.1672	.0291
1909	9	5,358,985.11	854,183.21	148,775.32	.1594	.0278
1910	10	6,117,307.09	969,076.64	157,840.57	.1584	.0258
1911	11	7,001,381.05	1,137,136.55	180,224.70	.1624	.0257
1912	12	8,036,323,87	1,311,994.00	199,020.21	.1633	.0248
1913	13	9,265,410.77	1,567,727.35	222,527.34	.1692	.0240
1914	14	10,702,488.65	1,804,883.09	275,927.33	.1686	.0258
1915	15	12,469,026.74	2,297,920.96	293,800.54	.1843	.0236
1916	16	14,587,696.13	2,622,408.27	389,189.92	.1798	.0267
1917	17	16,966,432.08	2,934,562.81	410,309.26	.1730	.0242
1918	18	19,586,594.58	3,139,878.72	423,807.28	.1603	.0216
1919	19	22,549,172.96	3,657,428.51	448,343.19	.1622	.0199
1920	20	26,265,393.35	4,699,021.95	475,666.49	.1789	.0181
1921	21	30,928,567.89	5,675,066.77	572,073.14	.1835	.0185
1922	22	36,518,154.56	6,730,517.82	654,339.12	.1843	.0179
1923	23	43,197,328.72	8,051,188.96	769,020.33	.1864	.0178
1924	24	51,143,256.80	9,522,431.09	912,743.57	.1862	.0178
1925	25	60,679,341.84	11,523,760.01	1,061,277.45	.1899	.0175
1926	26	72,268,377.79	14,009,566.47	1,293,977.13	.1939	.0179
1927	27	86,427,688.36	17,180,653.99	1,577,622.19	.1988	.0183
1928	28	103,503,472.54	20,687,985.18	2,139,448.61	.1999	.0207
1929	29	123,897,767.38	25,292,561.66	3,052,508.55	.2041	.0246
1930	30	147,351,290.66	28,892,579.16	4,225,585.70	.1961	.0287
1931	31	172,865,680.80	31,733,057.45	5,371,270.62	.1836	.0311
1932	32	200,693,580.52	35,628,564.27	6,334,551.66	.1775	.0316
1933	33	230,433,360.94	38,391,370.46	8,205,822.23	.1666	.0356
1934	34	260,919,870.77	40,884,448.04	10,096,976.61	.1567	.0387
1935	35	292,869,354.77	44,720,517.61	11,609,021.04	.1527	.0396
1936	36	327,022,117.63	48,215,343.26	13,021,314.10	.1474	.0398
1937	37	363,162,982.37	51,069,726.90	13,982,026.59	.1406	.0385

rate of 5.65% thus developed is illustrated in Chart A.

This rate, when combined with a salvage factor of 9% based on experience, results in a net depreciation rate of 5.14%, which is used thereafter until the 28th year. At this time a new estimate is developed by the use of a ten-year band from the 19th to the 28th year inclusive. This is illustrated in Chart B.

Similarly, a new estimate is made in the 36th year using the ten-year experience from the 26th to the 35th year, inclusive as shown in Chart C.

The use of bands makes it possible to build up reserves on the basis of estimates which actually could have been made at the points indicated. The use of cumulative ratios gives some weight to all prior experience but the use of bands gives greater weight to the more recent experience. The normal equations for the function $A=a'+b'x^{-1}+c'x^{-2}$ are developed for the method of Least Squares. These are:

$$n'a'+b'S(x^{-1})+c'S(x^{-2}) = S(A)$$
$$a'S(x^{-1})+b'S(x^{-2})+c'S(x^{-3}) = S(Ax^{-1})$$
$$a'S(x^{-2})+b'S(x^{-3})+c'S(x^{-4}) = S(Ax^{-2})$$

where n' is number of observed ratios and

S indicates the sum of successive values indicated.

The coefficients of the constants a', b' and c' in the left-hand members of the above equations are found directly from tables of $S(x^{-n})$ compiled for this purpose.

The normal equations for the function $R=a+bx^{-1}+cx^{-2}$ may be set up in a similar manner.

The solution of the above normal equations and evaluation of the constant terms a' and a for each of the bands yields the required limits of A and R, respectively. These limiting values are used to compute the geometric mean or d. Under the straight-line theory of depreciation, d, equals the annual depreciation rate uncorrected for salvage. The concurrent salvage studies are used to compute the net depreciation rates which are employed to develop Table III.

In the example used to illustrate the asymptotic method, it would be difficult, if not impossible, to obtain results by the proper application of other methods. There are no readily available records from which a mortality study[7] can

[7] Edwin B. Kurtz. "Life Expectancy of Physical Property." Ronald Press. 1930.

be developed. A good description of the actuarial approach to the depreciation problem is given by Robley Winfrey[8]. The so-called "turnover" methods may be applied on the basis of additions and retirements from fixed capital, but here the basic theory is at variance with the facts. The method developed by L. R. Nash[9] is an excellent example of the "turnover" method.

Of course, it is sometimes possible to develop some data as to age distribution of dollars retired and the dollars surviving which are needed to construct mortality curves. However, this entails a great expenditure of time and money in most instances because of the mass of detailed data which must be analyzed to develop the basic information required. Even in such instances where this is possible, the basic data are often unreliable and the analysis must of necessity be limited to a few years because of the incomplete data and the cost. A study encompassing a few years' data results in a so-called "band" which may be used to develop retirement ratios at various ages. These data form the basis of the actuarial study. The mortality curve for a particular property may be developed by analogy, that is by finding a "type" curve which seems to fit the observed retirement ratios; or by fitting a curve by the method of Least Squares; or freehand. The objections to the freehand method are simply the fact that the method is subjective and that it is not based on a rigid mathematical foundation. The method of analogy is subject to criticism because it offers no direct relationship between the observed data and the "type" curve and is denounced by both the courts[10] and the companies in their determination of "fair value" for rate-making purposes. The "type" curves may be developed on the basis of studies of property which is outmoded, obsolete, and often substantially different from the specific property under consideration. Fitting the observed ratios by the method of Least Squares is not subject to these criticisms. However, it is usually impossible and always impractical to reconstruct retirement data for a property's entire history. This leads to a determination of annual depreciation and of accrued depreciation on the basis of the fitted or theoretical mortality curve. The method of determining accrued depreciation on the mortality curve basis is relatively simple. The mortality curve is used to find the life expectancy at various ages. The life expectancy of the property in question, in years, based on its age, is multiplied by the percent annual depreciation rate to find the percent of cost new which it is expected will accrue in the future. The difference between one hundred percent and the sum of these future accruals is taken as the percent accrued depreciation. It is at this point that the strongest criticisms of the mortality curve method of determining accrued depreciation may be made. The "band" may be too narrow to be representative of the property in the long run. The life expectancy is a direct function of the mortality curve and, therefore, the shape of the theoretical mortality curve selected plays a great part in the determination of accrued depreciation. The theoretical mortality curve is subject to errors of interpolation and extrapolation associated with curve fittings. This means that the actual mortality curve never follows the theoretical curve exactly. Thus, even in the case where the predicted average service life is identically equal to the actual average service life, the theoretical life expectancy need not coincide with the actual future service life at any age. In actual experience, the average service life of groups of units put into operation over a long period of years varies due to changing conditions as well as chance variations. This means that the reserve for depreciation, which is built up in accordance with accounting practice by the application of a uniform annual depreciation rate, will not agree with the theoretical accrued depreciation or the theoretical reserve requirement at all times. In most cases in which accrued depreciation must be determined for valuation or tax purposes, it is desirable to correct for past management errors which have failed to build up a "proper" reserve on the books of account. The management may be willing to admit that it must make adjustments to the reserve for depreciation if such reserves are to be representative for accrued depreciation. It cannot be denied that a company which has made "adequate and proper" provision for annual depreciation under the straight-line theory, where "adequate and proper" is taken in the light of the best available methods

Table III—Application of Annual Depreciation Rate and Development of Built-Up Reserve

Year (1)	Average Balance (2)	(a) Per cent Net Annual Depreciation (3)	Amount Net Annual Depreciation (4)	Net Retirement Loss During the Year (5)	Balance in Reserve at Beginning of the Year (6)	Percent Reserve at Beginning of the Year (7)
1900, Aug.1	363,972.64	4.00	6,066.21		-	
1901, Jan.1	414,497.90	4.00	16,771.92	2,341.11	6,066.21	1.61
1902	499,352.46	4.00	16,574.53	1,405.72	20,497.02	4.43
1903	522,044.76	4.00	20,881.79	11,046.81	38,665.80	7.49
1904	539,239.22	4.00	21,569.57	421.29	48,500.78	9.18
1905	548,380.16	4.00	21,935.21	41,566.34	59,649.06	12.66
1906	566,128.68	4.00	22,645.15	19,257.78	40,017.93	9.15
1907	602,085.28	4.00	24,083.41	24,129.97	53,605.30	9.15
1908	632,467.78	4.00	25,298.71	36,492.17	53,558.74	8.66
1909	676,036.23	4.00	27,049.25	10,572.80	42,365.28	6 55
1910	758,321.98	4.00	30,332.88	6,239.57	58,832.64	8.34
1911	884,073.96	4.00	35,362.96	20,459.53	82,925.95	10.22
1912	1,034,942.82	4.00	41,397.71	16,667.60	97,829.38	10.22
1913	1,229,086.90	4.00	49,163.48	19,396.19	122,559.49	11.01
1914	1,437,077.88	4.00	57,483.12	46,224.64	152,326.78	11.32
1915	1,756,538.39	5.14	90,830.06	15,379.74	163,585.26	10.70
1916	2,118,669.39	5.14	108,899.61	66,766.12	239,005.58	11.93
1917	2,378,735.95	5.14	122,267.03	17,419.85	281,139.07	12.59
1918	2,620,162.50	5.14	134,676.35	5 231.14	385,986.25	15.29
1919	2,952,578.38	5.14	151,779.53	14,903.78	515,431.46	18.98
1920	3,716,220.39	5.14	191,013.73	17,424.14	652,806.21	20.34
1921	4,663,174.54	5.14	239,687.17	69,285.31	826,393.80	19.57
1922	5,589,586.67	5.14	287,334.75	57,746.23	996,795.66	19.53
1923	6,679,174.16	5.14	343,309.55	97,692.01	1,226,354.18	20.18
1924	7,945,922.08	5.14	408,420.73	113,362.83	1,471,971.72	20.21
1925	9,536,085.04	5.14	490,154.77	116,142.42	1,767,329.59	20.52
1926	11,589,035.95	5.14	595,676.45	187,734.52	2,141,341.94	20.46
1927	14,159,310.57	5.14	727,788.56	239,839.92	2,548,983.87	20.05
1928	17,375,784.18	5.14	877,695.31	461,253.72	3,036,932.51	19.46
1929	20,394,294.84	4.66	950,374.14	766,794.98	3,453,377.10	18.62
1930	23,451,523.28	4.66	1,092,934.18	1,078,934.79	3,636,956.26	16.35
1931	25,514,390.14	4.66	1,188,970.58	1,056,918.84	3,650,955.65	14.80
1932	27,827,899.72	4.66	1,296,780.13	848,656.42	3,783,007.39	14.35
1933	29,739,785.42	4.66	1,385,873.77	1,187,813.37	4,231,131.13	14.44
1934	30,486,509.83	4.66	1,420,671.36	1,163,028.26	4,429,191.50	14.67
1935	31,949,484.00	4.66	1,488,845.95	1,278,795.13	4,686,834.60	15.22
1936	34,152,762.86	5.68	1,939,876.93	1,115,517.47	4,896,885.42	14.79
1937	36,140,864.74	5.68	2,052,801.12	692,830.37	5,721,244.88	16.26
1938					7,081,237.63	19.09

(a) 1900-1914 5.00%x.80* Depreciable
1915-1928 5.65 x.91 "
1929-1935 5.83 x.80 "
1936 7.28 x.78 "

*Est.

[8] "Statistical Analyses of Industrial Property Retirements," Op. cit.

[9] L. R. Nash, "Public Utility Depreciation Accounting," The Journal of Land and Public Utility Economics, October, 1926, Vol. II, No. 4.

[10] Re Michigan Federated Utilities, P.U.R. 1930D, 506. (U.S.C.C.A.) Arkansas Louisiana Gas Co. v. Texarkana (1938) 24 P.U.R. (N.S.) 267, 96 F (2d) 179.

of determining annual depreciation, will have an "adequate and proper" reserve for depreciation. This reserve may be called the "built-up reserve." On the other hand, there is no way of proving at any point in time that the future accruals to the reserve will equal the estimates on the basis of theoretical remaining life expectancy. Futhermore, the built-up reserve is developed in complete accord with the Federal Income Tax Statutes[11] which require that depreciation be charged annually on the basis of facts known at the time such charges for depreciation are determined. Therefore, the reserve based on the theoretical life expectancy may not be "adequate and proper."

The asymptotic method makes it possible to determine the "built-up" reserve when it is impossible to do so on the basis of actuarial studies. In addition, the asymptotic method does not require the assumptions as to a particular shape mortality curve and as to a uniform rate of growth, nor does it impose the condition that two turnover cycles have been experienced all of which are prerequisites for the application of the "turnover" methods. For example, the "Nash"[12] method assumed the square type survivor curve.

It must be pointed out that the use of the results obtained by the asymptotic method is subject to the limitations of any mathematical depreciation study. The results must be checked with engineers and others who are familiar with the physical property as to the reasonableness of the results as to the amounts of accrued depreciation and annual depreciation in the light of their anticipation of future events. The annual depreciation rate developed by the asymptotic method is merely a basis of estimate and is subject to adjustments under special conditions which cannot be taken into account by a strictly mathematical computation based on past experience.

In closing, it may be of interest to illustrate the reasonableness of the asymptotic method by its application to human mortality data. The death rates and birth rates for the ten-year period 1919 to 1928, inclusive, in the United States[13] were fitted by the asymptotic method. The average life indicated was 61 years. The result agrees perfectly with the weighted average life expectancy at birth of males and females in the United States which is 61 years, based on the 1929-1931 experience table.

[11] See Sec. 23L, 113(b), 114(a), Revenue Act of 1938. Article 23(1)-5. Regulations 101. Treasury Bulletin F, January, 1931. T.D. 4422 and Related Bureau Rulings.

[12] Op. cit.

[13] World Almanac, 1939, pp. 323-325.

Eighth American Scientific Congress

THE Eighth American Scientific Congress will be held in Washington, D. C., from May 10 to 18, 1940, under the auspices of the U. S. Government and in connection with the celebration of the 50th anniversary of the founding of the Pan-American Union. Although the Eighth American Scientific Congress will convene a few weeks subsequent to the anniversary date, April 14, the Congress will be one of the important phases of that notable celebration. The Congress will be divided into 11 sections, including Statistics, and Economics and Sociology.

The Government of the United States of America attaches particular significance to the forthcoming Scientific Congress as an important factor in the promotion of cooperative effort among the governments and peoples of the Americas, and it is hoped that prominent scientists throughout the continent may be in a position to contribute to the achievements of the Congress by bringing to the discussions the wealth of their knowledge and experience, while enjoying the opportunity of renewing old and making new friendships among the other delegates present on this occasion.

Cooperative Engineering Courses Offered by Three New York Schools

THREE New York technical institutions in cooperation with the Westinghouse Electric and Manufacturing Company have announced the inauguration of a series of post-graduate courses to enable qualified graduate engineers to study modern research and manufacturing methods while earning credit for masters' or doctors' degrees.

The schools cooperating to provide this unique educational plan include New York University, Polytechnic Institute of Brooklyn, and Stevens Institute of Technology.

Under present arrangements engineering graduates may enroll in courses given by Westinghouse lecturers at Company plants and offices. Credit thus earned may then be applied toward a master's or doctor's degree from any one of the three institutions. The courses are designed to present the latest developments in various fields of engineering practice and instruction includes discussion of processes more recent than existing data in the most modern of textbooks.

Completion of enrollment last fall marks the first time that courses have been held in the New York area in which an industrial concern has cooperated with a group of educational institutions to provide advanced training for graduate students seeking higher degrees.

Northwest Association to Hold Business Development Meeting

THE annual Business Development meeting of the Northwest Electric Light & Power Assn. will be held at the Olympic Hotel, Seattle, Wash., Feb. 29 and Mar. 1, according to C. Patrick Johnson, section chairman.

The meeting will consist of three one half-day general sessions, taking up all aspects of sales work and business developments, and one half-day session devoted to concurrent bureau and committee conferences. The bureaus which will meet separately in these conferences, with their chairmen are: Commercial & Industrial Sales, J. A. Lockhart, Pacific Power & Light Co.; Residential Sales, J. F. McAllister, Utah Power & Light Co.; Rural Sales, J. C. Scott, Puget Sound Power & Light Co.; and Advertising, John Dierdorff, Northwestern Electric Co. Several speakers prominent in the industry nationally are being invited to appear on the program of the general sessions. At the last general session, brief summary reports will be heard from the bureaus and committees.

A Complete List of

E.E.I. PUBLICATIONS

Will Be Sent Upon Request to

EDISON ELECTRIC INSTITUTE

420 Lexington Ave., New York, N. Y.

Modern Kitchen Bureau Activities

TWO of The Modern Kitchen Bureau's big programs for 1940 are already off the press. The "Electric Range Revue" and the "Donald Duck" campaign for electric water heating are complete in all details, and samples of the promotional materials have been widely distributed to utilities and their representatives.

Electric Range Revue

The electric range program is a year-round activity which can be launched at any time and followed up effectively throughout the rest of the year. National magazine advertising in *Saturday Evening Post, McCall's* and *Better Homes and Gardens* runs through 1940, backing up your local program at all times.

There are display sheets, reproductions of the magazine advertisements, a striking window banner, forceful direct mail folders, a series of brief radio announcements and another of mats for your own newspaper advertising, all prepared so that they can be used without change or easily adapted to meet any local situation. The Bureau has absorbed all costs of preparing this material, so that it is available for your use merely at the cost of production. The big window banner, for example, in full colors, cost $1,010 to produce, but is supplied to you at 10 cents each—as many as you want.

This program means more range sales wherever it is put into action. First response indicates that it will have a wider acceptance than any other program released by the Bureau in the past five years, and that housewives everywhere will realize its full impact.

IT'S STILL A THRILL TO MODERNIZE!
FAST AS FIRE... WITHOUT THE FLAME!
CLEAN AND CHEAP LIKE ELECTRIC LIGHT!
1890 ELECTRIC LIGHT
1940 ELECTRIC COOKING
COME IN AND SEE OUR 1940
ELECTRIC RANGE REVUE

Poster for 1940 Modern Kitchen Bureau Electric Range Program

Electric Water Heater Program

The Bureau's 1940 electric water heater promotion is built around Walt Disney's famous animated cartoon character, Donald Duck, whose campaign slogan is: "Life is Duck Soup with Safe, Clean, Carefree Electric Water Heating." The campaign has been developed on the theme that electric water heating is as modern as electric light.

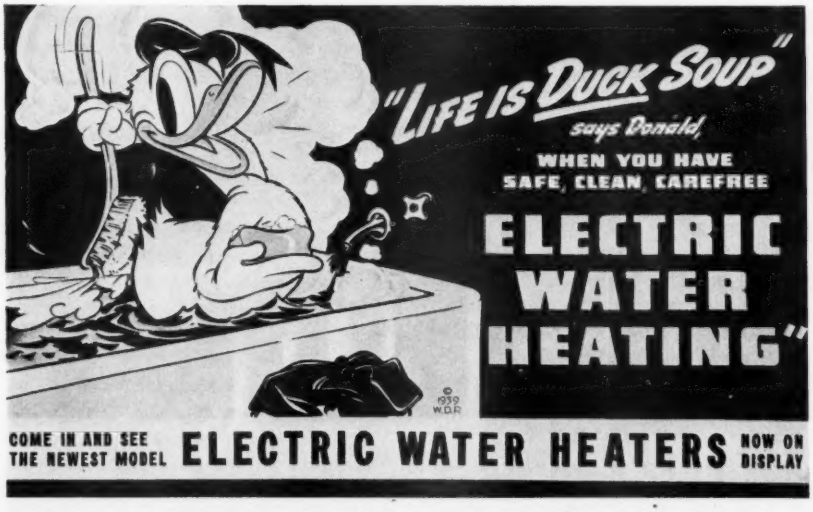
The Plan Book for the Electric Water Heater campaign describes every step in organizing and conducting your own activity in your own territory. It emphasizes the use of receipted bills and testimonial letters from present users as a method of dramatizing the economy feature. Once your prospects learn how little electric water heating costs their neighbors they are much more than half sold.

Donald Duck's sales manual is a masterpiece in itself. Written in verse, it leads the water heater salesman through every step with his prospect until the sale is closed, and is so entertaining that the prospect himself will enjoy reading the booklet while he absorbs the "reasons why."

This program, too, is backed by national magazine advertising appearing every other month in *Better Homes and Gardens*. For local use there is the three-foot window banner, enlargements of the national magazine advertisements, mats for local newspaper advertising, two clever direct mail folders, and a fine series of radio announcements.

Materials for these two campaigns are unusually fine. The campaign plan is based on past experience, and will produce results. Each supplements the other, and both are essential to full success. The two campaigns have been designed to help the utility company increase sales, and every utility company can make profitable use of them. If you have not yet seen these two programs, write the Bureau at once for plans and samples of the promotional materials.

Campaigns for the electric refrigerator and the electric roaster are nearing completion, and will be released during February.


"LIFE IS DUCK SOUP" says Donald,
WHEN YOU HAVE SAFE, CLEAN, CAREFREE
ELECTRIC WATER HEATING"
1939 W.D.P.
COME IN AND SEE THE NEWEST MODEL
ELECTRIC WATER HEATERS
NOW ON DISPLAY

Poster for 1940 Modern Kitchen Bureau Electric Water Heater Program

Henry L. Doherty

HENRY L. DOHERTY, president of Cities Service Company, died Dec. 26 of bronchial pneumonia at Temple University Hospital, Philadelphia. He had been in ill health since 1927, but continued his varied activities to within two weeks of his passing.

A former president of the National Electric Light Association, and the holder of the first Certificate of Membership issued to individual members, his death ended a career which made a notable impression on his contemporaries. His business and financial acumen as a utilities and petroleum operator marked him as an outstandingly successful business leader. His creative talents made many contributions, sometimes revolutionary in importance, to the progress and social value of the two industries he represented. His strong, and often iconoclastic individualism, made him a fabulously colorful and influential figure in American life.

Mr. Doherty was born in Columbus, Ohio, on May 15, 1870, of Scotch-Irish parents. He quit school at the age of 10 to sell newspapers on the streets of Columbus. Two years later be became an office boy in the employment of the Columbus Gas and Electric Company. It was there, he told, that he began his self-education by reading the company catalogues. He devoted every available minute to study of gas and electricity. He advanced gradually, and in 1890 began to move about in various capacities as engineer or manager of gas, electric or traction companies in Madison, Wis.; St. Paul, Minn.; San Antonio, Tex., and Denver, Colo.

Coming to New York he organized in 1905 Henry L. Doherty & Company, bankers and operators of public utilities, and in 1910 the Cities Service Company, parent of nearly 200 oil, traction, light, gas and power subsidiaries throughout the country.

Despite his lack of formal schooling, Mr. Doherty won wide respect among his associates for his mathematical and scientific knowledge. In 1930 the Franklin Institute awarded him the Walton Clark Medal "in consideration of his outstanding and valuable work in the development of the manufactured gas industry." At that time he had more than 150 patents to his credit.

He was given the honorary degree of doctor of science at the University of Miami, doctor of engineering by Lehigh University and doctor of laws by Lincoln Memorial University, Cumberland Gap, Tenn.

Many of the advancements in the oil, gas and electric industries are credited to Mr. Doherty. His work in the conservation of oil and its extraction is widely recognized. In the utility industry he was the first to organize the new business department for the promotion of appliances and wider use of electricity, and was the originator of the Doherty three-part rate plan, the "readiness-to-serve" method of charging for gas and electric service.

Mr. Doherty was elected President of the National Electric Light Association in 1901. When he took office the N.E.L.A. was largely an engineering body. He saw the need for covering all utility work and at his advocation its program was broadened to include commercial and accounting activities. Much of the early growth and continued usefulness of the Association was due to his organizing genius and his boundless enthusiasm in advancing the whole of the electric art.

George W. Olmsted

GEORGE W. OLMSTED, vice-president and a director of the Long Island Lighting Company, died at Ludlow, Pa., Jan. 15, of a heart ailment. He was 65 years old.

Mr. Olmsted and Ellis L. Phillips founded the Long Island Lighting system 30 years ago. Previously Mr. Olmsted had been engaged in the leather business.

In addition to his business activities, Mr. Olmsted was interested in the Boy Scout movement and had served for many years as a member of the organization's national executive board. In 1931 he received the Silver Buffalo, highest award of the Boy Scouts, "for distinguished service to boyhood."

Mr. Olmsted was born in Ridgway, Pa., the son of Samuel A. and Frances Welch Olmsted. He began work early in life, receiving his chief formal education at the grammar school in Brockway.

At the time of his death Mr. Olmsted held offices and directorships in many organizations, including president, Delaware Olmsted Company, Olmsted Securities Corporation and United Gas and Electric Corporation; vice-president and director, Eastern Seaboard Securities Corporation, Empire Power Corporation, Kings County Lighting Company, Long Island Lighting Company and J. G. Curtis Leather Company; treasurer, B. V. Harrison Company; director, Utilities Mutual Insurance Company, and trustee, Tanners' Research Laboratory of Cincinnati.

W. Paxton Little

W. PAXTON LITTLE, one of the pioneers in New York State electric power service, died January 7 at the age of 73 at the home of his daughter, Mrs. Henry D. Stailey, whom he was visiting in Los Angeles, California.

Mr. Little retired as treasurer of Niagara Hudson Power Corporation December 1, 1938, upon the completion of forty-five years of service with the associated and predecessor companies of the Niagara Hudson System.

Mr. Little's employment with the companies began in 1893 when he became auditor of The Cataract Construction Company.

Shortly after the successful completion of the plant, now known as Edward Dean Adams Station No. 1, Mr. Little installed the Niagara Falls Power Company's system of accounting and continued in charge of it when he was elected assistant treasurer and assistant secretary of The Niagara Falls Power Company in 1899, and as treasurer from 1905. He assumed the additional duties of vice president in 1926, retaining the title of treasurer. Mr. Little was also Auditor of the Pan American Exposition held in Buffalo in 1901 and of the International Traction Company from 1899 to 1905.

Mr. Little was chairman of the accounting committees of both the National Electric Light Association and the Canadian Electrical Association. He was awarded one of the earliest certificates issued by New York State to certified public accountants, held one of the oldest memberships in the New York State Society of Certified Public Accountants, and was a founder and charter member of the American Institute of Accountants.

Mr. Little was also among those who, at the request of the then newly formed New York State Public Service Commission in 1907, assisted in the formulation of the uniform system of accounts. Later he assisted in the preparation of the uniform system of accounts for the National Electric Light Association.

E.E.I. Engineering Committee Meetings

Accident Prevention Committee

W. R. SMITH, *Chairman*

THE thirteenth meeting of the Accident Prevention Committee of the Edison Electric Institute, will be held at the Jefferson Hotel in St. Louis, Mo., on Feb. 8 and 9. Although no program is available at this time, it is expected that there will be intensive discussions on the various problems confronting this Committee including public safety, employee training, resuscitation from electric shock, rubber protective equipment for linemen, and the coordination of activities with other committees for mutual benefits.

The work of this Committee deals specifically with the prevention of accidents in the electric light and power industry and the assembling and dissemination of information pertaining to methods of preventing accidents and the maintenance of health and well-being of employees.

Electrical Equipment Committee Program

Tentative—subject to minor changes

H. L. WALLAU, *Chairman*

Netherlands Plaza Hotel, Cincinnati, Ohio

February 12-13, 1940

MONDAY, FEBRUARY 12—10.00 A.M.
Closed Session

(Attendance limited to Committee Members and Representatives of E.E.I. Member Companies)

H. L. WALLAU, *Chairman*

Joint Committe O.C.B. Reports, R. W. Wilbraham
Joint Committee Bushing Reports, R. W. Wilbraham
Rehabilitation of Insulating Oils, H. S. Fitch
Changes in National Electrical Code, A. Maxwell
Round Table Discussion

MONDAY, FEBRUARY 12—2:00 P.M.
Closed Session

Apparatus Troubles.....C. A. Corney
Round Table Discussion

FEBRUARY 13—9:00 A.M.
Open Session

Meters and Services Division
A. E. SILVER, *Chairman*

Report .....A. E. Silver

System Engineering Division
R. A. HENTZ, *Chairman*

Normal and Emergency Ratings, F. D. Wyatt

Apparatus and Design Division
B. VAN NESS, JR., *Chairman*

Oil Fires .....R. A. Conwell
Modernization of 12th Street Station, Virginia Electric & Power Co., E. S. Fitz

FEBRUARY 13th—2:00 P.M.
Open Session

Utilization Equipment
J. H. FOOTE, *Chairman*

Reports on
Electric Welders
Water Heaters
Ranges J. H. Foote
Utilization Voltage Definitions....S. Stokes
Utilization Voltages .....J. H. Foote

Transmission and Distribution Committee Program

Tentative—subject to minor changes

W. F. NIMMO, *Chairman*

New Hotel Jefferson, St. Louis, Mo.

Feb. 5, 6 and 7, 1940

MONDAY, FEBRUARY 5—10:A.M.
Closed Session

(Attendance limited to Committee Members and Representatives of E.E.I. Member Companies)

Underground Group
C. W. FRANKLIN, *Chairman*

(a) Load Cycle Aging Test in Relation to Improvement of Solid Type Paper Cable, R. W. Atkinson, General Cable Co.

(b) Design Features and Use of Distribution Boxes and Manholes Recently Developed by The Consolidated Edison Company of New York, Inc., W. C. Kochendoerffer, Consolidated Edison Co. of N. Y., Inc.

(c) New I.P.C.E.A. Current Carrying Capacity Tables for Rubber and Varnished Cambric Insulated Cables, G. B. Shanklin, General Electric Co.

(d) Installation of Precast Manholes in New York City, C. P. Xenis, Consolidated Edison Co. of N. Y., Inc.

(e) Metallurgical Factors for Consideration in Choice of Materials, W. F. Davidson, Consolidated Edison Co. of N. Y., Inc.

MONDAY, FEBRUARY 5—2 P.M.
Closed Session

(f) Round Table Discussion, Underground Subjects.

TUESDAY, FEBRUARY 6—9:30 A.M.
Closed Session

Overhead Distribution Group
G. H. FIEDLER, *Chairman*

(a) Report on Street Lighting Subcommittee Activities, W. B. Elmer, Chairman.

(b) Development of Multiple Street Lighting System in Minneapolis, Minnesota, H. G. Conant, Northern States Power Co.

(c) Report of Distribution Transformer Field Load Testing Subcommittee, F. E. Sanford, Chairman.

(d) Thermal Characteristics and Review of Current Practices, F. E. Sanford, Cincinnati Gas & Electric Co.

(e) Selection of Transformer Size by Load Cycle Requirements, M. F. Bearers, General Electric Co.

(f) Report on Activity of Tree Clearance Subcommittee, G. D. Blair, Chairman.

TUESDAY, FEBRUARY 6—2:00 P.M.
Closed Session

Cooperative Projects Group
M. D. HOOVEN, *Chairman*

Plant Coordination Group
W. F. DAVIDSON, *Chairman*

(a) Coordination in Connection with Use of Shunt Capacitors on Distribution and Rural Feeders.

(b) A Small Neutralizing Transformer for Protection of Communication Circuits Entering Large Power or Switching Stations.

Overhead Transmission Group
D. M. BUNN, *Chairman*

(a) Maintenance and Treatment of Standing Transmission Poles, H. W. Graeber, Northern States Power Co.

(b) 275 kv Boulder Dam Transmission Lines, D. M. Simmons, General Cable Corp.

(c) Calculating Transmission Line Additions, V. G. Rettig, Cincinnati Gas & Electric Co.

WEDNESDAY, FEBRUARY 7—9:30 A.M.
Closed Session

Standards and Specifications Group
E. V. SAYLES, *Chairman*

(a) Report — Distribution Transformer Standardization, A. E. Silver, Ebasco Services, Inc.

(b) Report—Pole Line Hardware, E. H. Kendall, Commonwealth & Southern Corp.

(c) Report—Crossarm Specification, L. G. Smith, Consolidated Gas, Electric Light and Power Co.

Round Table Discussion.

Inspection Trips, 2:30 p. m.

Prime Movers Committee

E. L. HOPPING, *Chairman*

THE mid-winter meeting of the Prime Movers Committee will be held Feb. 5 and 6 at the Hotel Statler, Detroit, Mich. The meetings will start at 9.30 a. m.

The chairmen of the various subcommittees will report on the progress of their work to date. Also the chairmen of the new subcommittees which were appointed at the last meeting will outline the plans for their activities and these plans will be reviewed by the committee.

The Round Table discussion has a number of items scheduled which will prove of interest to the members present.

Plans have been completed for an inspection trip on Tuesday afternoon of the Delray Station. In this station there are two 85,000 lb boilers under erection and also a new 75,000 kw turbine.

PERSONALS

THOMAS W. MARTIN, Alabama Power Co. president, has been chosen by the French Government for the Palmes Academiques decoration in recognition of his work as a historian in compiling a book on French colonization and for his research and lectures on French colonists in Alabama. The announcement was made by Consul-General Rene Soulange-Teissier of New Orleans.

D. S. RICHARD, dealer sales manager of the Birmingham Electric Co., Birmingham, Ala., has been appointed residential sales manager to succeed Barney DeRamus, who has recently become associated with the Steel City Appliance Co., Alabama distributors for Crosley products.

PHILIP TORCHIO, who retired in 1938, at the age of 70, from the position of vice-president of the Consolidated Edison Co. of New York, Inc., has been awarded the 1939 Edison Medal of the American Institute of Electrical Engineers. The award was made to Mr. Torchio "for distinguished contributions to the art of central station engineering and for achievement in the production, distribution and utilization of electrical energy."

W. F. DAVIDSON, director of research, Consolidated Edison Co. of New York, Inc., New York, and recently appointed chairman of the Committee on Research of the American Institute of Electrical Engineers, has been appointed by the National Research Council to the chairmanship of its conference on electrical insulation.

Kansas City Power and Light has created a department, headed by CHARLES V. DUNN, for the technical advice and promotion of adequate and new wiring methods.

ALFRED G. NEAL has been elected president of the Potomac Electric Power Co., Washington, D. C. Mr. Neal has been acting president for the past several months, following the resignation of Dr. William McClellan to accept the presidency of the Union Electric Co. of St. Louis, Mo.

Mr. Neal started with the Potomac utility as assistant comptroller in 1918, was elected vice-president in 1925, and made general manager in 1933. He has served on the board of directors of Potomac Electric Power Co. and Washington Railway and Electric Co. and held membership on the executive committee of the company since 1934.

W. ALTON JONES, first vice-president of the Cities Service Company since 1927, was elected president of that utility system at a special meeting of the board of directors. He succeeds the late Henry L. Doherty.

Mr. Jones came to New York in 1921 from Missouri to become assistant to the late Frank W. Frueauff, partner of Henry L. Doherty. On the death of Mr. Frueauff, the following year, Mr. Jones took over some of his responsibilities and in 1925 he was made chairman of the executive committee of Henry L. Doherty & Company. In 1922 he was elected a director of Cities Service Company. His unusual ability as an executive and leader brought him further recognition when in 1927 he was elected first vice-president of Cities Service.

His business activity has been exclusively with the Doherty organization. His first position was that of cashier with the Webb City & Carterville Gas Co. at Carterville, Mo. In the fall of 1912, he was advanced to the position of cashier in the office of the Empire District Electric Co. at Joplin, Mo., where he advanced through various positions in the accounting and financial departments to assistant secretary, auditor and treasurer. During this period he also had charge of the rate department. Largely because of his record in handling the financial affairs of the Empire company during the trying war period he was called to New York in 1921.

Mr. Jones was elected first vice-president of the National Electric Light Association in 1929, and served as president in 1930-1931.

A. S. ANDERSON, formerly assistant superintendent of distribution, New Orleans Public Service, Inc., New Orleans, La., is now connected with Ebasco Services, Inc., New York, N. Y.

JOHN H. KENT, manager for the Boston Edison Company in the Newton and Needham districts, was guest of honor at a luncheon on Jan. 2, marking his completion of 35 years of continuous Edison association. Mr. Kent's son, Jackson, also a Boston Edison employee, was designated by Vice-President Thomas Carens to attach the 35-year service emblem to his father's lapel. His associates in public relations presented him with a fitted traveling bag.

R. S. TAYLOR, formerly division engineer, Oklahoma Gas and Electric Company, Muskogee, is now with the district engineering department of the company at Oklahoma City.

HAROLD E. MEADE, vice-president of the New Orleans Public Service, Inc., was elected president of the Electrical Association of New Orleans at the recent annual meeting.

R. B. MCELROY, formerly residential sales manager of the Washington Water Power Co., has been named general sales manager, according to a recent announcement by J. E. E. Royer, vice-president and general manager.

The position of general sales manager has been held by LEWIS A. LEWIS, assistant general manager and manager of the Spokane division of the company's operations, and the appointment of Mr. McElroy will relieve Mr. Lewis of general sales staff work.

A native of Spokane and a graduate of the State College of Washington, Mr. McElroy went immediately into the sales department of the Washington Water Power Co. During the twenty-odd years spent with the utility he has held positions in the residential, commercial and industrial sales fields, specializing in merchandising.

Other changes announced, effective Jan. 1, are as follows: M. R. LUND, selected as general commercial sales manager; A. H. WEGNER, sales manager of the Spokane division, and FRANK TOOL, formerly sales manager of the Spokane division, named as manager of residential sales.

R. B. CAPRON has been made distribution engineer for the Central New York Power Corp., with headquarters at Watertown, N. Y. He was formerly district engineer at Potsdam.

RECENT E.E.I. PUBLICATIONS

A-C NETWORK OPERATION, 1936-1937

E.E.I. Pub. G-1. A report of the Transmission and Distribution Committee, Edison Electric Institute, 49 pages. Price, 80c. to members and their employees; $2.00 to non-members in U.S.A.; $2.10 to foreign countries.

Sixty-nine companies operating 222 network areas in 121 cities or localities have submitted data which have been compiled and tabulated in this report for the period 1936-1937. These data have been analyzed, in general, on two bases, i.e., in relation to per cent of total peak load and per cent of reporting localities.

The total peak load served by low voltage a-c networks in 1937 showed an increase of 37.6 per cent over that reported for 1935. The total reported installed transformer capacity showed an increase of 27.4 per cent for the same period, which results in a continuation of the improvement in load-transformer capacity ratio.

The allowable voltage variation at customers' services, when compared either on a total peak load basis or the total number of localities, indicates that either 73.1 per cent or 58.7 per cent, respectively, are operated at plus or minus 3 to 3.5 per cent allowable voltage variation. The trend toward this objective voltage range is contrary to that experienced as reported in the 1935 Report.

The performance of network protectors under fault conditions requiring the clearing of defective primary equipment at the secondary side of the network transformer has improved 25.2 per cent over the record for the previous report. Excluding those failures not directly chargeable to the protector, this failure record is the best shown in any of the preceding seven years.

Assuming the present secondary major fault record or rate to be typical, the expectancy or rate of occurrence of major faults on the secondary grid is approximately one major fault per 100 miles of equivalent 3/c and neutral secondary cable every two years. At the present failure rate for equivalent three-phase network transformer banks, the expectancy rate for failures is approximately one failure in each 100 equivalent three-phase transformer banks every two years. Approximately 93 per cent of all complete network outages for the last seven years are occasioned by failure of the source of power to the network primary feeders.

The conclusions reached and the tabulated data presented in this report should be accepted with the realization that it is extremely difficult to select a method whereby the trends could be presented where the data of a large number of small units would not overshadow the performance of a small number of large units. Conversely, when compared on a basis of size, the reverse condition would be true. Realizing that a weighting factor would be greatly influenced by individual opinions and experience, the conclusions reached in the report may not necessarily present a correct picture when a comparison to an individual network is made.

COMBUSTION—1939

E.E.I. Pub. G-3. A Report of the Combustion Subcommittee of the Prime Movers Committee, Edison Electric Institute, 44 pages. Price, 80c. to members and their employees; $2.10 to non-members in the U.S.A.; $2.15 to foreign countries.

This report contains statements by Operating Companies and Manufacturers on:

Pulverized Fuels and Furnaces (other than pressure parts of water-cooled furnaces).

Combustion Control.

Fly-Ash Collectors and Ash Handling.

Mechanical Draft Equipment.

In the 1939 Report, emphasis is laid on operating experiences with high pressure plants installed during the last four years. Satisfactory results are indicated by data on operating problems, equipment, performance, etc., as presented under the four separate subject sections. Each section of the Report is prefaced by a subcommittee statement which discusses the subject and contents of the section.

The following comments taken from the Report refer to matters of general interest, and touch on some important features of the Report.

During the 1939 coal strike coal reserves that had been in storage for 10 to 20 years were utilized. These resources, due to the long exposure, had in some cases deteriorated and in many instances the stored coal was a much poorer grade than current supplies. In certain locations coal piles had been completely inundated by the floods of 1936 and 1937, which left large quantities of gravel, clay and sand over and through all parts of the storage supplies. All of these conditions contributed to various troubles experienced during the strike period with pulverizing mills, burner equipment, slag-tap furnaces and combustion systems. At one plant the large quantity of gravel and clay in the coal resulted in a stoppage of the flow of slag, eventually causing a shutdown of the boiler on account of the solidification of the ash on the slag bottom. Companies that were located at points where fuel oil could be advantageously purchased and having boilers equipped with combination burners, switched to oil firing in order to avoid a complete depletion of coal reserves. One company burned a combination of oil and pulverized anthracite in slag-tap furnaces designed for bituminous coal. Results were not altogether satisfactory. In an effort to further protect power output during future extended interruptions in normal coal supplies, and to take advantage of possible price differentials, many companies plan to provide a combination of oil and coal burners to boilers now fired with pulverized coal.

Combination Burners: The question of equipping boilers with combination coal, oil and gas burners arranged for alternate or simultaneous burning of these fuels, was a live topic about ten years ago when the price of Bunker C oil receded to a point that justified the changing to oil firing of many pulverized-fuel, and some stoker-fired installations. At that time the capacity of boilers involved was in almost every case below 200,000 lb per hr, coal burners were relatively small in capacity and heat release in furnaces was moderate, so that the problem of changing existing coal burners and adding oil-firing units to existing coal burners was relatively simple.

As of today, the rating of central station units ranges from 300,000 to 700,000 lb per hr and the capacity of coal burners has been greatly increased. Single pulverized coal firing units handling 10,000 lb per hr of coal, equivalent in steam generation to about 100,000 lb

per hr, are commonplace. A single oil burner of the same steam rating would be required to atomize 7,600 lb of oil per hour. This, of course, is beyond the capacity of individual oil burners currently obtainable. High capacity combination coal and oil burners in furnaces arranged for intertube, cross-tube, tangential and other coal-burner units of this type present problems in air supply and distribution as well as in the development of mechanical- and steam-atomizing apparatus. The conversion of high-capacity circular burners to combination coal and oil units is also a matter that is arresting the attention of equipment manufacturers. There is an increasing demand for combination coal and natural gas burners to take advantage of low off-peak rates which are being made available to power stations adjacent to natural gas pipe line systems.

Slagging: Statistics given in the Pulverized Fuel and Furnace Section covering a list of ten representative high pressure installations, show that slag and ash removal from water walls and tube surfaces has accounted for many boiler outages during the last year, and man-hours expense for cleaning of these parts is high. It is probable that the slagging problem occurs to the greatest extent with slag-tap units, which carry higher temperatures in the combustion zone and other sections of the furnace.

Deslaggers and wall cleaning units are devices which have been introduced in the last three years to cope with slag accumulations. These devices are in addition to the standard soot blower elements, although in some cases they supplant certain of the latter. Whether these new deslagging units are a permanent adjunct of certain types or all types of high-capacity pulverized-coal boilers remains to be seen. However, the first cost, the man-hour operating expense and the steam or water requirements are new items which must be taken into account in the economic analysis of power production costs. The installation of these cleaning units must be justified by improved availability or economy.

Slagging of superheaters is a serious problem and apart from the trouble and expense involved in removing slag, there is also danger of subjecting tubes to excessive temperatures. As passages between tubes become choked, the gas flow concentrates in the less-clogged gas passages. These conditions produce blowtorch effects which cause overheating and failure of tubes. Superheater troubles are being alleviated by providing tube arrangements with wider spacing than has heretofore been in use. The economic effect of these changes is an increase in superheater surface and first cost. The general adoption of designs along this line for high-temperature installations using pulverized coal would seem warranted.

Dust Collector Efficiency of Over 90 per cent: Operating experiences with mechanical and electrical units as reported in the Fly-Ash Collector Section indicate that equipment can now be furnished to meet the most exacting requirements as regards the release to atmosphere of objectionable ash and dust particles. Operating tests showing efficiencies of over 90 per cent are included in the statements made by operating companies.

Automatic Combustion Control: On account of rapid fluctuations in load, convenience of operation, the possible improvement in combustion conditions during load changes and in some cases for favorable economic reasons, the installation of full-automatic combustion control has, in general, become identified with the modern central station steam-generating unit. However, there are some unfavorable features common to all automatic systems. These include: high first cost, high maintenance and too many instruments and accessories which may cause interruptions.

Fairly frequent manual operations must be employed since the full-automatic system cannot maintain satisfactory fuel-air ratios as long as a number of uncontrollable factors enter into the operation of the boiler. Some of these are: changing furnace conditions due to slagging or other causes; inadequacy of furnace by-passes and by-pass dampers; furnace air leakage; uncertain excess air determinations; variations in air supply for combustion received through air heaters, tempering ducts, mills, etc. These matters are discussed in statements included in the Combustion Control Section.

Fan-Capacity Shortages: From information given in the Mechanical Draft Section, it would appear that forced draft fan capacity shortages which are referred to in operating statements are largely traceable to processes used in the development of design by fan manufacturers. With large-capacity high-speed units, shop facilities suitable for performance tests under full load conditions have not been available. For this reason manufacturers must depend on theoretical assumptions when designing fans much in excess of the capacities of shop tested units. There is also the possibility that the addition of control vanes to fans of standard design may be a contributory cause of the deficiencies in units so equipped. This situation is receiving the attention of fan manufacturers.

ELECTRIC METAL-MELTING FURNACES

E.E.I. Pub. G-4. A Report of the Industrial Power and Heating Committee, Edison Electric Institute, 36 pages. Price, 80c. to members and their employees; $2.00 to non-members in the U.S.A.; $2.15 to foreign countries.

During the past thirty years the electric melting furnace—whether of the arc or induction type—has demonstrated its superiority as a melting medium where quality of product is an essential. The past few years have witnessed a continual growth in the number of furnace installations and, with the expanding market for metals and alloys possessed of accurately controlled physical and chemical properties, the number of future installations should greatly increase.

Other relatively unexplored fields of application include the melting of glass, frit and rock; copper melting and refining; and various other electrometallurgical and electrochemical processes.

The encouraging outlook for load expansion in this field suggests that electric utility sales organizations familiarize themselves with the opportunities and problems incidental to serving electric melting furnace loads.

While there are numerous books as well as articles scattered through the technical press, on the subject of electric melting furnaces, little condensed and readily accessible information is available to the power sales engineer interested in the promotion of this type of load. It is believed that this report will not only fill such a need but will also stimulate greater interest in the possibilities of load building by means of the electric melting furnace.

Farm Electrification Handbook

The Farm Electrification Handbook recently issued by the Agricultural Power Committee, Pacific Coast Electrical Association, provides in readily usable form facts and data on electrical devices and their application to agriculture. These are presented to serve as a guide to rural power men in promoting the use of electric service on farms in order to reduce the cost of production through saving labor, time and money; simplify power applications; increase production; and increase farm profits.

Its 175 pages of factual information are supplemented with supporting tables and many excellent charts and illustrations. The contents is subdivided into the following sections:

I. Agricultural Pumping
II. Dairy Industry
III. Poultry Industry
IV. Electric Motors—Controls, etc.
V. Miscellaneous Farm Uses
VI. Domestic Farm Uses
VII. Engineering Data
VIII. Agricultural College Bulletins and Pamphlets
IX. Farm Accidents
X. Irrigation.

The Handbook may be purchased from the Pacific Coast Electrical Association, Inc., 601 W. Fifth St., Los Angeles, Calif., at $3.00 per copy.

Commercial Cooking and Baking Sales Manual

A SALES manual on commercial cooking and baking was prepared by the Commercial Section, N.E.L.A., some time ago. It contains a large amount of helpful basic data which is still valuable to commercial electric cooking salesmen.

A few hundred copies remain in stock. The Cooking Council will be pleased to supply these in lots of five or more without charge other than the shipping costs.

Requests for copies should be addressed to:

Commercial Electric Cooking Council, 420 Lexington Avenue, New York City, N. Y.

SEVENTH ANNUAL SALES CONFERENCE

March 20-21, 1940

Calling the attention of all Commercial men to the Seventh Annual Sales Conference of Edison Electric Institute at Edgewater Beach Hotel, Chicago, March 20-21. The General Sessions will be preceded by an open meeting of the entire Modern Kitchen Bureau on Tuesday, March 19. March 18 is Committee Day.

An additional feature will be a banquet on Wednesday evening, March 20.

Mark these days on your calendar now for the annual rendezvous of utility, manufacturer and other groups interested in electric load building activities.

What?

100,033

Radio-Phonograph Units In One Campaign!

That is the record in the campaign inaugurated by E. F. Jeffe, Vice President, Consolidated Edison System, New York City, and run from September 1, to December 23, 1939.

According to the manufacturer of the device, the Campaign resulted in the largest number of Radio-Phonograph Combination sales ever secured in a similar period not only by one manufacturer, but by all manufacturers in the country combined. Last year the System Companies and their Cooperating Dealers sold 230,609 radios in a combination package campaign in the same territory. This would seem to indicate that customers served by this utility system will buy the things they want if they are attractively priced and under deferred payment plans that come within their income.

At the same time, the Cooperating Dealers, through the pool arrangement that was set up, earned a greater profit per Radio-Phonograph Combination than usually obtains. The "pool" worked in this way. Company employees received a bonus of $1.00 for each unit sold. This sum was paid out of the profits derived from the sales made by Company employees and the remainder, after deductions for delivery, and a reserve, was distributed to Cooperating stores pro-rata as to the verified sales reported by them. The first division of the pool made on November 10 amounted to $5.07 per set sold by the dealer for installation in the territory. The second pool distribution totaled $4.00 per set sold by the dealer. This is considerably higher than the estimate made prior to the start of the campaign. In addition, any balance remaining out of the reserve set aside will be further distributed to Cooperating Dealers when the term of payment has been completed.

Here is an example of cooperative selling that benefited customer, dealer, utility and manufacturer.

The Weather and the Power Companies

(*Continued from page* 18)

overhead lines, and also information on expected high wind velocities.

Mr. McKinley brought out the fact that the Weather Bureau serves three general groups: first, the general public; second, those people who have need for special weather forecasts and third, those groups such as the airlines that require immediately available localized refinement in the forecasts. Power companies fall generally into the second group, with large metropolitan companies and companies which have sizeable hydro properties also in the third group. Both the second and third groups have need for obtaining forecasts more often than once a day. Mr. McKinley suggested that the local mailed maps might be dispensed with if newspapers could be used to disseminate the maps. Commercial radio stations might be used more freely to give out detailed local forecasts and services of the Civil Aeronautics Authority's broadcasting stations might be adjusted to release regional broadcasts every six hours, with probably a briefer broadcast every three hours, be further suggested.

Mr. Rossby reviewed the field of meteorological research and reported on the progress made in developing more refined methods of forecasting and also the prospects for long range (5 to 10 days) forecasting in the future.

The forecasting of storm rainfall was illustrated by Messrs. Showalter and Bollaty of the Weather Bureau, by discussing progressively a series of synoptic weather maps, covering a storm period in the southeastern United States from

January 12 to 16. This discussion brought out several important phases of modern forecasting and particularly the utilization of information on the upper-air masses involved. The isentropic charts were utilized in the discussion and explained. The demonstration clearly brought out the necessity for the forecaster to have before him data in the form of charts of different types, prepared at frequent intervals, to be able to render a reasonably accurate forecast.

Mr. A. B. Campbell and Mr. D. C. Hopper of the Transmission and Distribution Committees, outlined studies which have been made during the past 13 years on glaze and simultaneous wind velocities in connection with the formulation of rules for minimum requirements for safety for overhead lines. Prior to these studies there was practically no Weather Bureau data available as to the collection of glaze on overhead power line conductors. In their review of this study and the results which have been obtained, they spoke highly of the cooperation which has been received throughout the entire country from the various Weather Bureau stations.

Mr. Bernard of the Weather Bureau described the river and flood forecasting service conducted by the bureau, covering 73 river basins throughout the country. The great floods occurring in recent years have brought about the extension of this service into the head waters of the larger rivers necessitating more refined methods of forecasting and more detailed information regarding precipitation and river stages.

Mr. Little of the Weather Bureau described the service rendered to the aviation interests throughout the country. There are approximately 100 Weather Bureau stations located at airports, manned throughout the 24 hours of the day, preparing four weather maps daily. The activities of the aerological service are closely coordinated with the general weather service and where necessary, specific information regarding weather can frequently be obtained directly from the airport stations.

In the evening, a special meeting was held at the Weather Bureau, where the staff on duty demonstrated the reception and decoding of the data and the preparation of the 7:30 p.m. weather maps and forecasts.

Dr. Irving P. Krick, Associate Professor of Meteorology at the California Institute of Technology and Director of the Krick Industrial Weather Service of Pasadena, Calif., describing the development and operation of this special service. He explained the detailed forecasts prepared to meet the needs of the subscribing utility companies. These forecasts are transmitted by teletype. He cited examples where information regarding glaze storms and lightning storms had been given to one of the large eastern power companies, materially aiding it in maintaining electric power service in the areas affected. He also cited examples of the prediction of rainfall on the Coosa River in Georgia, which aided in the operation of hydro and steam plants. Dr. Krick's services include special detail forecast and also general forecasts of future weather developments.

Mr. Duryea of The Commonwealth & Southern Corporation, described the operation of the hydro stations in his organization's territory, and the dovetailing of these operations with the operation of their steam stations. He also explained the use of Dr. Krick's service.

Dr. Petterssen of the Massachusetts Institute of Technology gave an interesting forecast of the development of meteorological science over the next ten years.

Mr. Minser of TWA discussed the role of the private meteorologist in the service of the airways, pointing out how the electric utilities might use meteorologists or some private meteorological service to meet their special requirements as have the airlines. One meteorologist on a staff, he said, would not satisfy these requirements, since such work is a 24-hour, seven days a week job.

This meeting gave to the utility representatives present a clear picture of the services both present and future that they might expect from the Weather Bureau, as well as the limitations involved in Weather Forecasting. Conversely the Weather Bureau representatives were given a clear picture of the requirements of the public utilities in rendering their service to the public.

CONVENTIONS AND MEETINGS

JANUARY

22-26 American Institute of Electrical Engineers, New York, N. Y.
22-26 American Society of Heating and Ventilating Engineers, Cleveland, Ohio.
22-26 National Warm Air Heating and Air Conditioning Association, Cleveland, Ohio.
29-30 Iowa Public Utilities Association, Annual Sales and Distribution School, Fort Des Moines Hotel, Des Moines, Iowa.

FEBRUARY

4-8 National Electrical Manufacturers Association, New York, N. Y.
5-6 Prime Movers Committee, EEI, Detroit, Mich.
5-7 Transmission and Distribution Committee, E.E.I., Jefferson Hotel, St. Louis, Mo.
8-9 Accident Prevention Committee, E.E.I., Jefferson Hotel, St. Louis, Mo.
12-13 Electrical Equipment Committee, EEI, Netherlands-Plaza Hotel, Cincinnati, Ohio.
14-16 Meters and Service Committee, E.E.I., Richmond, Va.
22-23 Southeastern Electric Exchange, Engineering and Operation Section, Robert E. Lee Hotel, Jackson, Miss.
29-Mar. 1 Northwest Electric Light & Power Association, Annual Business Development Meeting, Olympic Hotel, Seattle, Wash.

MARCH

Wk. 18th General Sales Conference, E.E.I., Edgewater Beach Hotel, Chicago, Ill.
19-20 Missouri Valley Electric Association, Joint-Rural-Sales Conference, Continental Hotel, Kansas City, Mo.
21-22 Missouri Valley Electric Association, Engineering Conference, Continental Hotel, Kansas City, Mo.

APRIL

16-18 11th Annual Greater New York Safety Council Congress, Hotel Pennsylvania and Hotel Governor Clinton, New York, N. Y.
17-19 Missouri Association of Public Utilities, Elms Hotel, Excelsior Springs, Mo.

MAY

6-9 Technical Committees, E.E.I., Edgewater Beach Hotel, Chicago, Ill.

JUNE

3-6 EDISON ELECTRIC INSTITUTE, Atlantic City, N. J.

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